RIGHT! Over 90% of Putnam's output consists of end mills . . . the natural result of undivided attention in developing and continually improving this one type of cutting tool. Over 800 standard end mill types and sizes, the largest available ***anywhere*** and ***all*** in stock, can be delivered immediately.

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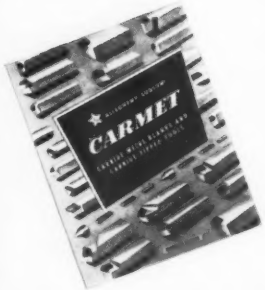
PUTNAM

Tool up Faster!

with

CARMET CARBIDE MET

STANDARD TOOLS AND BL



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. . . also for price list
. . . great helps when you need tools fast.

Need cutting tools in a hurry? Just name the sty styles and carbide grades desired . . . get prompt ment from a big stock *near* you.

Our line of carbide "standards" is complete. It c 90% of all single-point operations. CARMET sta tools come ready to use . . . easy to modify for sp purposes, by grinding. Style C, illustrated, is des particularly for conversion into various shapes fo merous applications. Other standard CARMET also are immediately available from local stocks.

Order CARMET tools and blanks for better, cheaper cutting. There is a grade to take care of every

Allegheny Ludlum Steel Corpora
CARBIDE ALLOYS DIVISION, Detroit 20, Michi

AL

WSD 3708 B

Distributors: Write us about handling CARMET Standard Tools in your area.

686
375
311

311 more pieces per grind!

CLE-FORGE HIGH SPEED DRILLS with crankshaft point give best results in exhaustive test

Before the test, the average number of pieces per grind was 375. The drills were pointed to a 90° included angle, and the flutes were thinned by hand. At the suggestion of a *Cleveland* Service Representative, the point was changed to the crankshaft type, ground by machine. The new point cut more freely, reducing end pressure on the spindles; and eliminated the human element in hand thinning the web. At the conclusion of the test, CLE-FORGE High Speed Drills were 'way out in front *with an average of 686 pieces per grind.*

✧ A *Cleveland* Service Representative will be glad to help solve *your* drilling problems. Contact your nearest Stockroom, or . . .

Telephone Your Industrial Supply Distributor

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

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E. P. Barrus, Ltd., London W. 2, England

ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS

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TOOL & DIE JOURNAL

TOOLING AND PRODUCTION

MEMBER:
CONTROLLED CIRCULATION
AUDIT, INC.

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TOOL & DIE JOURNAL is published monthly for plant operating and purchasing executives and department heads in 50 types of end product and contract manufacturing companies.

Every copy is directed to such an individual by name, by title, and by company gratis. See CCA certification.

These men, from whom emanate recommendations, requisitions and orders for needed materials, tools, equipment and accessories, comprise the Cycles of Buying Influence within their respective plants—CBI—and it is they who constitute TOOL & DIE JOURNAL'S ever-vital reader circulation.

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NEXT MONTH

"Quality Control in the Press Department", by Clifford W. Kennedy. This article by Federal Products Corporation's Quality Control Engineer answers a frequently asked question: Is there some practical statistical quality control technique for the press shop? Mr. Kennedy's answer is, "Yes," and he backs it up with experience and performance records. As he says, " . . . it's the old 'stitch in time' principle . . . the cost of press tool maintenance goes down" and the method enabled production to foretell the need for tool service before " . . . a run of junk slid down to the tote box"! As usual, Mr. Kennedy's know-how can be put to work in the shop tomorrow.

"Jig and Fixture Applications of Welded Construction", by Wade H. Kerr, Warner Gear Company. When to weld and when not to weld can be determined by this presentation of the factors that determine the practicalities and economies of welding in the construction of: a drill jig; a lathe loading and unloading fixture; a work-holding steady rest for a tool grinder; and a loading device for a broaching fixture.

"A Lamination Punch and Die", by Robert Mawson. A motor lamination die case history emphasizing the preliminary considerations necessary to insure successful construction and operation: steel selection; heat treatment; alignment; ejection method; and rigidity.

"Die Casting Die Design", Part IV, continued, by H. K. Barton and James L. Erickson. A continuation of the authors' detailing of: the factors essential to correct sprue design and location; methods for preventing "freezing" of the molten metal within the sprue; and sprue design features affecting the turbulence of the in-flowing metal.

"The Use of Inclinable Punch Presses", by J. I. Karash, Plant and Process Engineer, Reliance Electric and Engineering Company. In this concluding installment the author deals with: automatic separating chutes which preclude the otherwise expensive and tedious sorting job when different sized pieces slide out the back of inclined presses; the handling of dies in an inclined press; and the variable speed drive as related to the inclined press.

New Products
Production Machines, Tools and Accessories. Toolroom Equipment. Measuring Tools and Gages.

New Literature
Catalogs, Pamphlets, Data.

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Theirs is the responsibility of producing stampings quickly and cheaply with a minimum of delay. They are doing it successfully with DICKERMAN DIE FEEDS . . . these sturdy feeds increase production and decrease cost. Profit by their experience and install DICKERMAN DIE FEEDS on your own presses . . . they'll pay for themselves in a surprisingly short time. H. E. Dickerman Manufacturing Co., Springfield, Mass.

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TOOL & DIE JOURNAL

A Versatile Press THAT *Costs You Less!*

The NEW BUNELL UNIVERSAL HYDRAULIC

Does All These Jobs

- Spotting of Dies
- Tryout of Dies
- Molding

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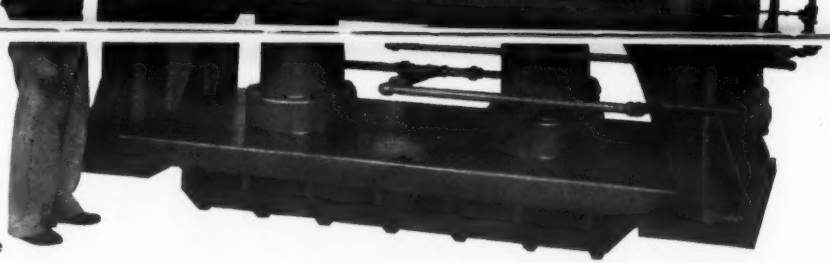
- Tryout of Dies
- Molding
- Laboratory Tests
- Die Blank Development
- Production of Steel Stampings
- Straightening
- Assembly Under Pressure



FLEXIBLE DESIGN to Meet Your Requirements

Offers These Advantages:

- Low Initial Cost
- Low Operating Cost
- Safe Press to Operate
- Pressure Can Be Regulated
- Only Two Moving Surfaces, Easily Adjustable for Wear

The new BUNELL Universal Hydraulic Press is simplified in design, versatile in performance . . . and its low cost is only a fraction of the price of standard hydraulic or crank presses.

Why pay for a larger size press or larger frame than you need? The efficient BUNELL Press is built in *any size* to meet your exact specifications on stroke, die space, tonnage and bed area.

Phone, write or wire for full information or quotation. Inspect this remarkable press in operation in our plant.

WRITE FOR CATALOG *describing* BUNELL *machines, facilities, methods and equipment.*

THE BUNELL MACHINE & TOOL CO. CLEVELAND, O. BUNELL

BUNELL MACHINE AND TOOL CO.

1601 EAST 23rd STREET • CLEVELAND 14, OHIO

Since 1920, Designers and Builders of Special Tools, Dies, Jigs, Fixtures and Special Machines

CARBIDE USERS:

ADAMAS "works" on these jobs!

JOB	ADAMAS CARBIDE USED		ADAMAS RESULTS
Turning electric motor shafts, SAE 3140 steel, from 2" down to 1½" in one cut.	Specification: Style #2310 Standard blank, ADAMAS Grade D. Delivery: Immediately from stock.		Increased production up to 150 pieces between grinds.
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Facing cast iron gate valve. Intermittent cut over flange holes on 20" O.D.	Specification: Style V-439 standard blank, ADAMAS Grade A. Delivery: Immediately from stock.		Increased cutting speed from 90 to 240 feet per minute. Tripled number of pieces between grinds.
Replacing rapidly wearing bushings on precision jeweler's lathes used in fine watchmaking.	Specification: Preformed bushing, ADAMAS Grade A. Delivery: 8 days after order received.		ADAMAS Carbide bushings eliminated play and maintained required tolerance for 16 months without replacement under constant use.

Let ADAMAS CARBIDE cut your costs and speed your production

Write Dept. "D" for recommendations on your job, or, ask for an Adamas field man to call.

ADAMAS
CARBIDE CORPORATION
1000 South 4th Street • Harrison, New Jersey

Producers of top quality carbide for cutting tools, dies and wear resistance

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Firth Sterling's New-Handy Pocket Size Tool Crib

Six 3/8" Firthite General Purpose Tools (assorted styles) and Hone in Plastic Case

Ideal for the Small Shop Operator—for experimenting with carbide cutting tools at low cost.

Ideal for the Machinist—who wants to keep a practical assortment of small Firthite tools—in a handy kit in his tool chest for those occasional jobs when he needs a ready-to-use tool—and doesn't want to take a chance that the tool crib is "all out."

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These fine Firthite Tools will cut case-hardened steels, other metals, plastics and abrasives. Each plastic case contains chart of cutting speeds and other useful machining information.

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A NEW WAY TO C

From flat stock to → *Vulcan-draw* = *one corner formed*

Vulcan
Designs and Builds
Dies
Tools
Machines
Fixtures
Equipment

Rotate the sheet forming one corner at a time . . . . overall specified dimensions are held . . .

Vulcan-draw

VULCAN TOOL CO., **730 Pritz St. DAYTON 10, OH**

CUT PANEL COSTS

For medium production schedules you draw one corner at a time...eliminate costly draw dies...eliminate costly notching, hand welding, and finishing...Use simple corner punch and die for all sizes with the same corner radius...switch in a few minutes to a similar die for a corner of different radius.

You further cut costs by releasing punch press equipment for other work. Most any radii and any panel size from 15" x 18" up to the largest panel can be handled in the Vulcan-draw . . . A pedal starts a few seconds hydraulic cycle producing a corner completely drawn and finish sized . . . Rotate the sheet and you get all corners with overall panel dimensions held . . . Former cost per corner and per finished panel is cut to fractions depending on the number and variety of short or medium run jobs to be done.

We will gladly forward additional information if your request includes your present panel part prints for our immediate proposal or recommendation. This will cover the Vulcan-draw, the corner dies, and all needed brake press, corner trim, and return flange dies to make fully finished panels at reduced cost. Present Vulcan-draw deliveries approximately 16 weeks.

GUARANTEED! WE'RE TOOL AND DIE BUILDERS SINCE 1916.

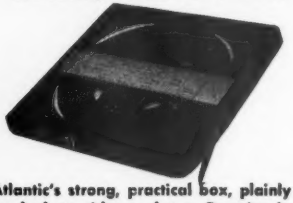
Specify ATLANTIC

BAND SAW BLADES

for Smoother

CONTOUR CUTTING

ATLANTIC SAWS meet all of your requirements for a superior blade on complicated die and fixture radius cutting. ATLANTIC specializes in accurate milled and precision set teeth, hardened to exact temper.



Atlantic's strong, practical box, plainly marked on sides and top. Remains in good condition until entire coil is used.

ATLANTIC'S special alloy steel insures longer wear and easier welding.

ATLANTIC'S one temper saw for all metals reduces stock you have to carry. Cut to length and welded, ready for use. Packed in strong Atlantic box. Write for new Atlantic Catalog.

Atlantic Saw Mfg. Co.

INCORPORATED

Exclusively Manufacturers of Band Saw Blades

160 Brewery St., New Haven, Conn.

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GRIND TOOLS TO EXACT ANGLE .. FASTER

PROSSER CARBIDE GRINDERS

Model AA for dry grinding

Model BB for grinding wet or dry

YOU GET the grinding angle you want *instantly* with the famous indexing feature of these Prosser high-speed grinders. The quick-acting tables need never be raised or lowered—and once set, they stay put.

ECONOMICAL—You'll save time and you'll get more for your wheel dollar with a Prosser because wheels are easily adjusted to compensate for wear. Wheels can be used up practically 100%.

VERSATILE—Designed by the same Prosser engineers who introduced cemented carbide to American industry, today's Prosser Carbide Grinders are equally effective on stellite and high-speed steel.

Before you get a grinder for rough work or fine finishing, wet or dry . . . get the facts on the Prosser. For details on bench and floor models, on chip-breaker, drill-grinding and other attachments . . . write for literature.

DEALERSHIPS AVAILABLE

Established 1845

THOMAS PROSSER & SON 120 Wall Street, New York 5, N.Y.

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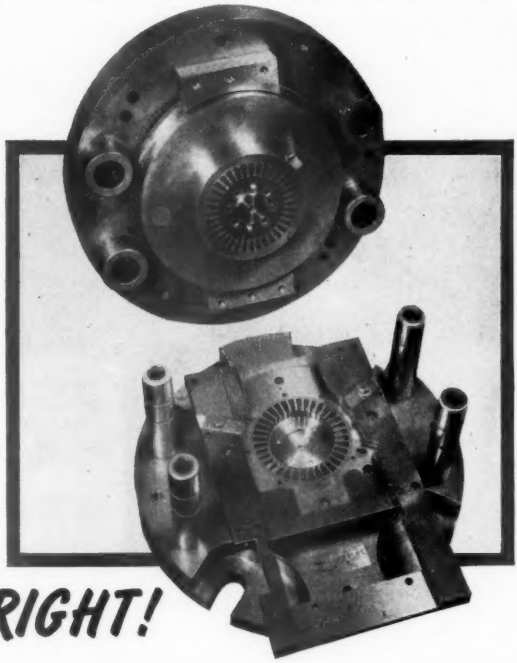
Illustrated—Tungsten carbide compound die for stator laminations



We Design *DIES* that do the Job *RIGHT!*

Tungsten Carbide or Steel Applications

DIES

Lamination
Piercing and Blanking
Compound Perforating

FORM TOOLS

Circular Dovetail
Flat

GAGES, JIGS and FIXTURES

To suit your most exacting requirements

Will you "give us a crack at" your very next tough job? We are in position to design a die from a piece part or from drawings which will exactly fill your needs. More than that, it will deliver you maximum *production* with the extreme *accuracy* you must have. Your assurance is to be found in our modern, efficient plant, thorough engineering, careful craftsmanship, and a long acquaintance with die requirements. You must always get — and we will give you — *production with accuracy.*

May we quote on your requirements?

CLEVELAND FORM TOOL COMPANY

6514 ST. CLAIR AVENUE • CLEVELAND 3, OHIO

DIE DIVISION

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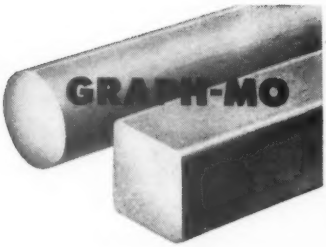
ONE STEEL DOES MANY JOBS



BUSHINGS • DIES • CAMS
STAMPS • TAPS • PUNCHES
GAUGES • SLITTING KNIVES
MANDRELS • ROLLS

TIMKEN® Graph-Mo is the one oil-hardening tool steel that has everything you need to do all of these tool room jobs.

Because of the free graphite in its structure, Timken Graph-Mo machines fast and easily. It has good anti-frictional properties, minimum tendency to scuff, seize, or score, and a unique ability to retain lubricants.

Graph-Mo has excellent stability. Surfaces may be finished to precision tolerances. Due to uniform response to heat treatment, distortion in hardening is prevented. And because Graph-Mo contains diamond-hard carbides, it offers unusual resistance to wear.

One of four Timken graphitic steels, Graph-Mo has gained wide acceptance as a general purpose steel for dies, gauges and machine parts. For specialized applications, these other Timken graphitic steels offer particular advantages in addition to the general graphitic tool steel qualities.

TIMKEN GRAPH-TUNG gives extra resistance to abrasion and extra high hardness to resist wear.

TIMKEN GRAPH-AL has extra impact strength. It has shallow hardening properties that make it stand up well under impact.

TIMKEN GRAPH-M. N. S. has unusually high bending strength—extra strength in small cross-sections and long lengths.

For the latest information on these exceptional steels, write for the new, enlarged 9th edition of the Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

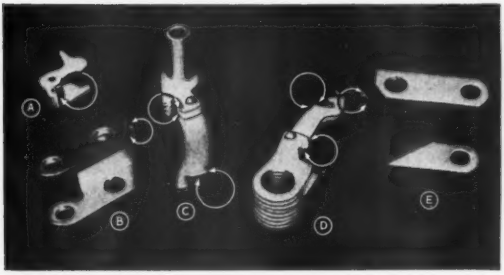
YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

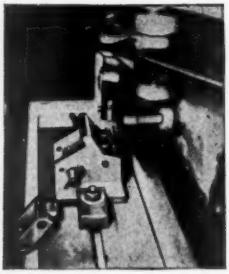
Specialists in alloy steel—including hot rolled and cold finished alloy steel bars—a complete range of stainless, graphitic and standard tool analyses—and alloy and stainless seamless steel tubing.

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

How to take the guesswork out of contour-grinding

Moore Panto-Crush Wheel Dressers Step Up Latch Output 30% for I-T-E, Assure Interchangeability of Parts.





Contour grinding of latch level—Part "E" at left. Here two surfaces and two radii, including inside fillet, are being ground simultaneously.

Five principal I-T-E circuit breaker parts finish ground with Moore Panto-Crush Wheel Dresser. Surface areas between arrows are ground. A comparison of pieces per hour between new method and old method follows:

Part	Moore Panto-Crush	Old Method	Saving
A	22	15	33%
B	32	22	31%
C	31	18	42%
D	14	12.5	10%
E	25	17	32%

I-T-E's experience with Panto-Crush Wheel Dressers was fully reported in "American Machinist." We'll gladly send you a reprint and our catalog.

They've taken the "by-guess-and-by-gosh" out of the contour-grinding of toggle latches at I-T-E Circuit Breaker Company, Philadelphia, switchgear manufacturers. Moore Panto-Crush Wheel Dressers have solved the problem of accurate, interchangeable production of these moving mechanical parts so essential to faultless circuit breaker operation.

Irregular contours are now ground by wheels diamond-dressed to exact dimensions within .0002". Before installing Moores, I-T-E ground the contours by shifting the parts at different angles. Accuracy and field interchangeability suffered. Today both are completely satisfactory, and output itself is up 30%!

The Panto-Crush is mounted on the wheel spindle of a surface grinder. It is the only wheel dresser combining a precision-built pantograph for guiding the diamond from a template and a self-driven crush former. You switch from one to the other without removing workpiece.

MOORE SPECIAL TOOL COMPANY, INC.
726 UNION AVENUE, BRIDGEPORT 7, CONN.

Moore Panto-Crush Wheel Dresser

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • COMPLETE LINE OF HOLE LOCATION ACCESSORIES

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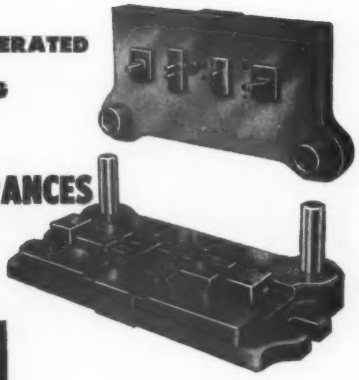
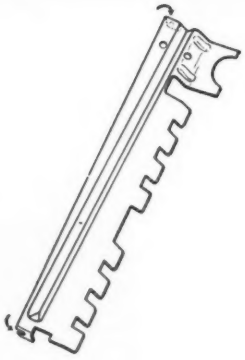
THIS CAM-OPERATED PIERCING DIE

MAINTAINS STRICT TOLERANCES

WITH A

PRODUCTO DIE SET





Call "Producto" in classified telephone directory in major stamping centers. Fast service thru 26 Producto Representatives.

When you're working with figures...as Monroe Calculating Machine Co. does...you can't tolerate even minor inaccuracies. That's why they selected PRODUCTO DIE SETS to keep their precision dies and punch presses in highly accurate relation to each other.

The cam-operated die pierces a fussy slot (.063 wide) in one end of various Selector Bails, and pierces a hole (.063) in the other end. (See arrows left.) Tolerances as close as ±.001 are maintained, with 50M to 75M pieces per grind.

When *you* order your PRODUCTO DIE SETS careful check-up will show precise alignment of guide pins and bushings, and closely held parallelism of punch and die holder...assurance of greater accuracy, longer die life...lower costs.

THE PRODUCTO MACHINE COMPANY

970 HOUSATONIC AVENUE, BRIDGEPORT, CONNECTICUT, TEL. 4-9481

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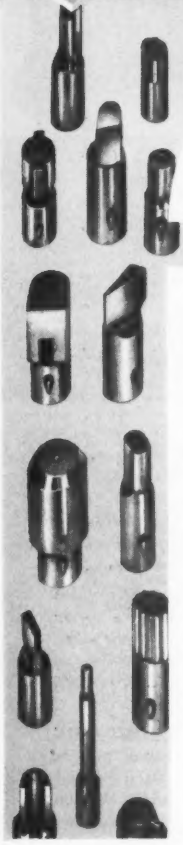
INTERCHANGEABLE PUNCHES and DIES



SPECIAL
PUNCHES and DIES that are INTERCHANGEABLE

Punches and dies with irregular shapes, for combination piercing and forming, or from special alloys, can be completely interchangeable just as all standard punches and dies. This feature and the use of standardized retainers saves time and money in the design, construction and operation of a die set.

If you need special punches, dies or components, whether or not you desire the interchangeable feature, we make them for you promptly—and to your specifications.

Get in touch with Allied and have your special punch and die requirements filled quickly . . . correctly . . . economically.

Get the WHOLE STORY *in this* FREE CATALOG

Complete information on standard and special interchangeable punches, dies and die-making components. Yours for the asking.

ALLIED PRODUCTS CORPORATION

Department 39 • 12635 Burt Rd. • Detroit 23, Michigan

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GOOD TOOLS . . .
Don't Cost Money
They Make Money

FIGURING TOOL COSTS ON PERFORMANCE ...NOT PRICE, PAYS BIG DIVIDENDS

Productivity—not pennies—is the only way to judge the cost of a tool. No tool deserves a place in your shop unless it can prove . . . on the job . . . that it will enable the machine to operate at peak performance, with minimum downtime.

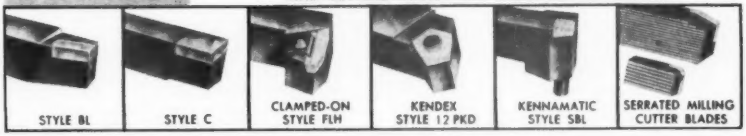
Kennametal cemented carbide tools are made by processes that are exclusive and expensive, but which are worth far more than the cost . . . because they assure a tool material of consistent soundness.

This Kennametal characteristic pays off—in your shop. In many instances, Kennametal tools will pay for themselves in savings effected in grinding, alone. And this does not take into account reduced tooling costs, and improved production rates attained.

We'll send you, on request, reports that show cost reductions of thousands of dollars on many different operations through the use of Kennametal tooling. But—there is a much better way to demonstrate. That's in your shop, on your job. Ask us to do it.

KENNAMETAL *Inc.*
LATROBE, PA.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY



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why pays to have these

WALES HOLE PUNCHING & NOTCHING CATALOGS

at your finger tips

CATALOG CJ
WALES Type "CJ"
FOR PUNCHING MILD STEEL UP TO 1/4" THICK
INCLUDING WALES TYPE "BL" NOTCHING UNITS
WALES-STRIPPIT CORPORATION
CATALOG N
WALES NOTCHING UNITS
FOR NOTCHING MILD STEEL UP TO 1/4" THICK
CATALOG BL
LES Type "BL"
NCHING MILD STEEL UP TO 1/4" THICK

● Before deciding on the hole punching and notching portion of your tooling program, check into Wales Catalogs where your particular problem may be solved by using STANDARD adaptations of STANDARD Wales Equipment. Join the thousands of manufacturers who have made it a rule to refer to Wales Catalogs before putting holes in sheets, angles and channels by ANY method.

Wales functionally-colored catalogs fully illustrate and describe the unlimited stamping press and press brake set-ups that are made possible by this Wales Equipment *that has revolutionized tooling.*

Remember, there's always something new in the Wales line so keep posted.

WRITE TODAY

for Wales

WALES-STRIPPIT CORPORATION

GEORGE F. WALES, *Chairman*

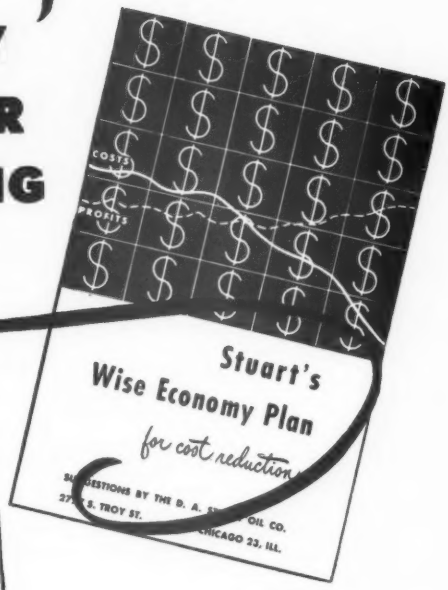
355 PAYNE AVE., NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

HERE IS THE WAY TO LOWER MACHINING COSTS



survey
suggestion
service
why D. A. Stuart Oil Co. is qualified to serve
Wise Economy Results From Wise Selection of Metalworking Lubricants

NOT just another spot check "oil survey", the Stuart plan is a scientific appraisal of a plant's over-all cutting fluid needs. Ask for details.

D.A. Stuart Oil Co.
EST. 1865 LIMITED

2729-37 South Troy Street, Chicago 23, Illinois

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Send Now for your 1950 Catalogs!

T-J

for

TOUGH JOBS

Looking for *labor-saving ideas?* Get the latest T-J Catalogs and study the facts about T-J Performance! You'll find scores of ways to *increase production* and *reduce costs* with T-J! Engineered with the know-how of 33 years . . . precision-built for utmost *accuracy* and *dependability*. Write . . . The Tomkins-Johnson Co., Jackson, Michigan.

T-J TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

HYDRAULIC CYLINDERS
Send for catalog H-47

AIR CYLINDERS
Send for catalog 43

AIR CONTROLS
Send for catalog 645

CUTTERS
Send for catalog 148

RIVITORS
Send for catalog 846 and 847

CLINCHORS
Send for catalog 847

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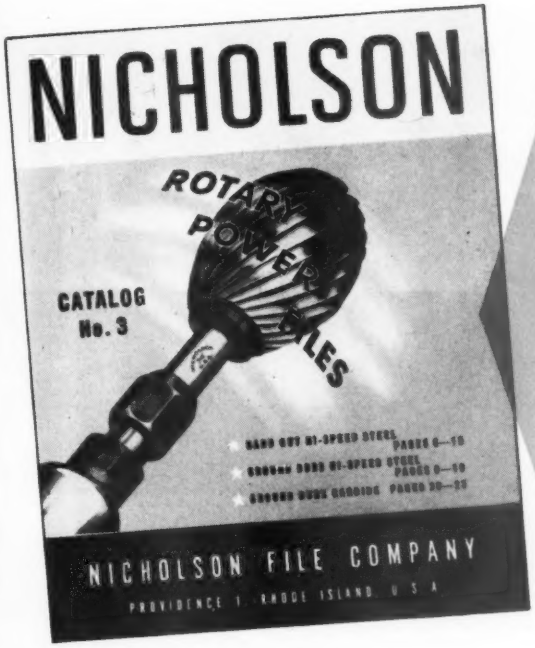

It's all here

. . . in this **NEW and REVISED** *Nicholson Rotary File Catalog*

IF YOU are still among those not fully acquainted with all the facts about Rotary Files and Burs and rotary power filing, write for the above free book (*new and revised*). It is not only a catalog of Nicholson Hand Cut High Speed Rotary Files, Nicholson Ground-from-Solid (fluted) High Speed Burs, and Nicholson Carbide Burs (having up to 100 times the wearing qualities of high speed steel). . . . But it also contains valuable information regarding the anatomy, selection and use of these modern power tools. Especially interesting are the discourses on these important aspects:

- *Choosing and using Rotary Files and Burs in die making, metal pattern making, mold finishing, tool making, and intricate parts finishing; High Speed Hand Cut Rotary Files versus Ground-from-Solid Burs;*
- *Recommended speeds for Rotary Files and Burs (for general applications);*
- *Carbide Burs and their proper speeds.*

Nicholson Rotary Files and Burs carry the assurance of high quality equal to that which has made Nicholson the world's leader in hand files under the famous Nicholson guarantee of *Twelve perfect files in every dozen*. Available singly or in quantities in all popular sizes, shapes and cuts, and in various standard kit assortments, through your industrial distributor.

NICHOLSON FILE CO. • 95 ACORN STREET, PROVIDENCE 1, R. I.
(In Canada, Port Hope, Ont.)

NICHOLSON ROTARY FILES
HAND CUT AND GROUND • HIGH SPEED STEEL AND CARBIDE
NICHOLSON U.S.A.

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MANY manufacturers are finding that permanent tooling on a new untested product is a needless risk, thanks to Quality's quick process tooling for short run production. Quick process allows them to make many alterations before tooling up for long runs. Thus the product can be perfected without running the risk of buying expensive permanent tools that might never be utilized. In addition, they find that permanent tooling can result in great losses where the market for a new product proves too limited for high production. In this case quick process tooling is a low cost solution to the problem of obtaining limited quantities of high grade metal stampings.

Get the benefits of the low initial expense of Quality's quick process stampings before your product is completely designed and market tested — *plus the advantages of Quality's finest permanent tooling for long, economical production when your product is proven.*

QUALITY

TOOLS • DIES • JIGS • FIXTURES
METAL STAMPINGS • ASSEMBLIES
SPECIAL MACHINERY

HARDWARE AND MACHINE DIV.
Continental Copper and Steel Industries, Inc.
5847 North Ravenswood Avenue, Chicago 26, Illinois

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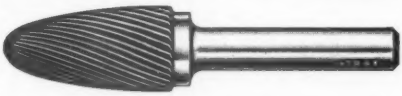
ATRAX CARBIDE BURS

⅛" Solid Carbide Burs—17 standard shapes available. Also ¼" Burs on ⅛" shanks in 9 standard shapes.

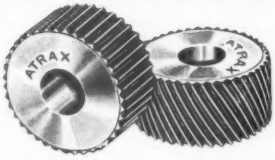


Large burs on ¼" shanks. Complete range of shapes available in Coarse, Standard, Fine and Special Cuts.

ATRAX BURS, precision ground of tungsten carbide, outlast ordinary burs more than 50 times without regrinding and effect savings up to 10 times on practically any material from plastics to hardened steel. Discover how much more you can get out of ATRAX CARBIDE BURS. Ask for Bulletin A-60 describing a complete range of sizes, shapes and cuts.

ATRAX CARBIDE KNURLS

Use carbide knurls on long runs or where steel knurls won't stand up. Atrax Knurls are perfectly concentric and holes, sides and flutes are uniformly ground to an exceptionally fine finish on special machines of our own design. Write stating your requirements, and benefit from our wide experience in grinding carbide knurls. Ask for Bulletin A-60.



ATRAX CARBIDE REAMERS

These are solid carbide reamers with an odd number of flutes — hence there are no opposing crushing loads on the cutting edges. Radius relief chamfer and highly lapped lands for better finishing and longer life. Ground to a tolerance of .0002. Sizes from 1/16" to 1" diameter; 1½" to 8" length. Bulletin A-62 gives you all the facts. Request it today.

ATRAX CARBIDE MILLS

A solid Carbide Mill is a more rigid mill. "Spring" of the steel shank is eliminated; there is no loosening of brazed tips; load is evenly distributed among the flutes. Because they operate at higher speeds, Atrax Mills produce a better finish and they will do in one cut what it usually takes two cuts to do. Bulletin A-64 describes 6 standard patterns, ½" and under.

THE ATRAX COMPANY

FRANCIS AVE. and DAY ST., NEWINGTON 11, CONN.

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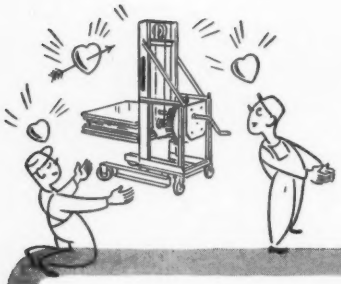


. . . the favorite with shopmen for heavy lifting jobs

SHOPLIFTER

A low cost machine ideal for one man operation in moving heavy dies in tool rooms, loading trucks, as an adjustable table for handling machine work, and a hundred other handy uses in the plant.

All steel, welded, framework. Easily operated hoist unit with automatic brake, holds load at any height.

500 pound capacity
Type D, hand operated.....$157.00
Type DE, electric 1/3 HP unit.....$315.00

1000 pound capacity
Type DX, hand operated.....$320.00

2000 pound capacity
Type DX, hand operated.....$370.00

Floor lock to hold machine steady:
$10.00 extra for 500 pound sizes;
$15.00 extra for type DX models.

Prompt Delivery

ECONOMY ENGINEERING COMPANY, 4509 W. Lake Street, Chicago 24, Illinois

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

8 Million grinds per year on 450 different set-ups ...cost less than ½¢ per grind

Volume production of precision parts at lowest cost is a *must* at Felt & Tarrant Mfg. Co., makers of the Comptometer. Use of Dumore Grinders for production has been a logical development, checked every step of the way by both the production and cost departments.

Permanent set-ups cut labor cost

Noting Dumore performance on tool room and maintenance jobs, Production tried them on the line, found them ideal from cost, accuracy and output standpoint. At present, they are using twenty-one Series 44's and nine older models. The set-ups average $25 apiece, are simple and permanent, permit use of unskilled labor. Total investment for the 450 individual set-ups is only $3,300 for Dumore Grinders and $11,000 for special mounting fixtures. Model changes, requiring new parts, are simply taken care of by building additional low-cost fixtures.

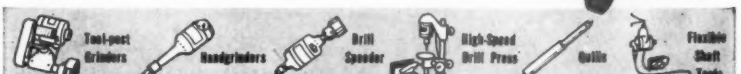
Dumore costs 1½c per hour to own

On a typical operation, Dumore, plus fixture depreciation, power, maintenance and supplies cost Felt & Tarrant only 34¢ per hour. Part, requiring 5 grinds, costs only 2¢ per unit, including labor.

Why not examine your grinding operations with an eye to incorporating Dumore economies. Your Dumore Dealer will be glad to recommend installations, and, if you wish, arrange for free demonstration in your plant. Call him, or write: The DUMORE COMPANY, Dept. A-42, Racine, Wisconsin.

DUMORE

DG-2



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MAKES IT EASIER TO RADIALLY RELIEVE CUTTING TOOLS

● You, too, can take advantage of the faster, cleaner cutting ability and longer life of radially relieved tools.

D-S has simplified the job. Any good grinder hand can produce this relief actually faster than regular angular back-off on taps, step drills, counterbores, profile mills, gear tooth rounding cutters, etc., of 1 to 14 flutes, with or without centers.

WRITE FOR OUR CATALOG ON TOOL GRINDING FIXTURES

D-S GRINDER DIVISION

ROYAL OAK TOOL & MACHINE CO.

621 E. 4th St. • Royal Oak, Mich.

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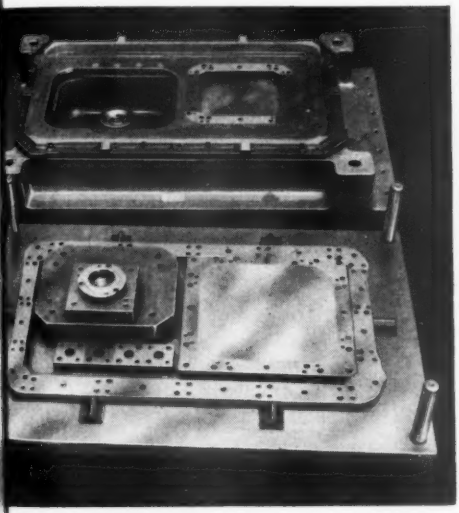
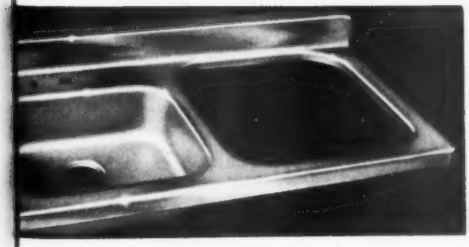
T'S NO SECRET TO WIVES . . .

that kitchen convenience begins in the modernized factory . . .

t more interested in modern conveni-
ce than in details of production, she
efers to accept the practical features
her kitchen just as she accepts its
aming streamlined beauty . . . as a
t of pleasant, modern living.





Thousands of women know the joy of lovely labor-saving sinks and dishwashers because of the skill and labor put into the design of such dies as that shown at the left. This die is typical of many designed and produced by Barth for progressive manufacturers.

The Barth Organization is helping many nationally known manufacturers and many small independent organizations to improve their product, stimulate their sales and better their profits.

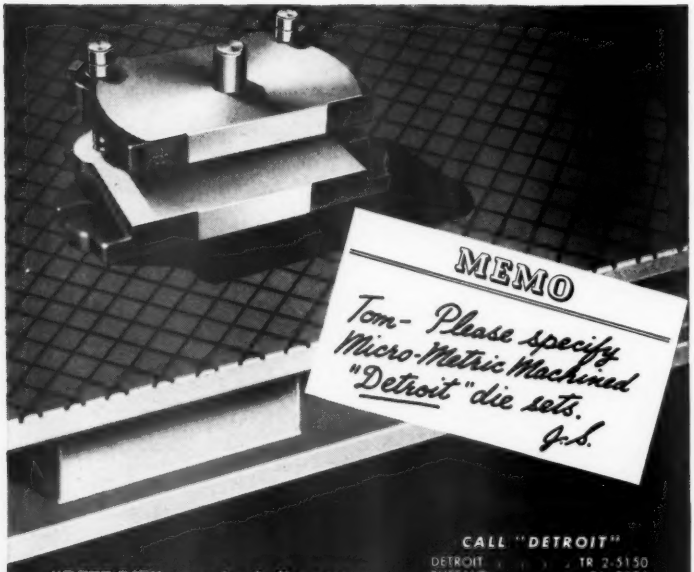
Barth Service includes Manufacturing, Complete Tooling, and Special Machinery designed and built for specific tasks.

Ask for the Barth Catalogue . . . it gives complete details on the three services offered to industry by Barth.

BARTH **STAMPING & MACHINE WORKS Inc.**

Denison at W. 34th St., Cleveland 9, Ohio

DESIGNERS AND BUILDERS OF DIES, TOOLS AND SPECIAL MACHINERY



"DETROIT" standard die sets are Micro-metric jig-bored and machined to exceptionally close limits of parallelism, flatness and squareness with the guide-pin axis. This precision reduces strain warping, and results in longer die life and long, uninterrupted production runs. Order from your "DETROIT" representative.

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LOS ANGELES	AD 7251
MILWAUKEE	ED 2-2359
MINNEAPOLIS	AT 5264
PHILADELPHIA	VI 4-4084
PITTSBURGH	Perrysville 3203
PORTLAND	WE 3254
ROCK ISLAND, ILL.	8-2814
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SAN FRANCISCO	EX 2-7018
SEATTLE	LA 7100
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DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICHIGAN

DETROIT DIE SETS ★

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Hammond

OF KALAMAZOO

CARBIDE TOOL AND CHIP BREAKER GRINDERS

CB-77 Chip Breaker and Diamond Finishing Grinder

Save

TIME

TOOLS

WHEELS

WD-10 Wet or Dry 10" Carbide Tool Grinder

14-WD Wet or Dry 14" Carbide Tool Grinder

Hammond Carbide Tool Grinders will soon pay for themselves thru greater wheel economy, longer tool life and FASTER grinding. They relieve toolroom bottlenecks and step up production. **Write for Carbide Grinder Catalog 220.**

Hammond Machinery Builders INC

1631 DOUGLAS AVE. • KALAMAZOO, MICH.

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DANLY DIE SETS

LESS TIME IN THE DIE SHOP

Die assembly work is easier and more accurate when it's based on reliable Danly precision.

LONGER LIFE ON THE PRODUCTION LINE

Hardened, ground and lapped leader pins and precise bushing fits assure accurate die relationship and more parts per grind.

Danly Die Sets will assure the performance of your dies... and they mean greater convenience too! Large or small, standard or special, there's a Danly Die Set quickly available to meet your specific tooling requirements.

All standard Danly Die Sets are "on hand" in a nationwide system of assembly branches for prompt delivery from stock!

Which DANLY branch is closest to you?

- *Chicago 50, 2100 South 52nd Avenue
- *Cleveland 14, 1550 East 33rd Street
- *Dayton 2, 990 East Monument Avenue
- *Detroit 16, 1549 Temple Avenue
- *Grand Rapids, 113 Michigan Street, N.W.
- *Long Island City 1, 47-28 37th Street
- *Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda
- Milwaukee 2, 111 East Wisconsin Avenue
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*Indicates complete stock

WRITE FOR THIS FREE BULLETIN

... and see how Danly's special die set machining service will mean important savings in your tool shop.

DANLY

DANLY MACHINE SPECIALTIES, Inc. 2100 South 52nd Avenue, Chicago 50, Illinois

OVER 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

TOOLING *for* ROLL-FORMING

With a recently established plant in Detroit, Yoder now offers you the facilities of three plants exclusively devoted to the design and making of rolls and other tooling for roll forming operations. Here you will find unsurpassed quality and service at competitive prices. Your inquiries solicited.

The YODER Company

5533 Walworth Avenue Cleveland, Ohio

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Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

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YOUR MILLING MACHINE CAPACITY

DOUBLED!

Convert your milling machine...horizontal or vertical...into a universal miller and *double* your capacity. Reduce set-up time by as much as two-thirds.

Built by one of New England's oldest metal working specialists, the MILMASTER is a sturdy tool of proven value. Wherever it is used it has paid for itself in a matter of hours.

Get the facts!

MAIL TODAY

BEMIS & CALL COMPANY
260 Main Street, Springfield, Mass.

Please send me the bulletin giving the full details on the Milmaster.

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Company_____

Address_____

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LIKE THESE

LIKE THESE

with the PRATT & WHITNEY KELLER CARBIDE

TRADE MARK

Keller Carbide DI-BURS are "diamond" *center-fluted and master ground by machine* to forever do away with the hazards of annoying steel slivers penetrating into operators' hands. This exclusive DI-BUR feature gives them the correctly staggered points—sharp-cutting points—that produce the harmless, granular chips illustrated above. (The small "flats", instead of points on an improperly-made bur make those needle-like slivers.)

Grinding from the shank end makes the DI-BUR run true with the shank . . . deepening the center-fluting at specified intervals makes for easy, smooth "nose-cutting". Features like these, plus Pratt & Whitney engineering and craftsmanship, make the DI-BUR produce amazingly fine finishes on the toughest of die steels, with maximum Productivity and Economy. For the full story on Keller Carbide DI-BURS, send for the P&W BUR Catalog.

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Chicago • Cincinnati
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Pratt & Whitney
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

KELLER *Carbide* DI-BURS

Grind Your Carbide Tools wi
for LESS

ls with NORTON
S Vitrified DIAMOND WHEELS

A fast cutting action *plus* long life — that's what you get with the Norton *Vitrified bonded* diamond wheel — that's why this patented Norton development will enable you to cut costs on many of your carbide tool and die grinding jobs.

For the offhand grinding of single point tools, for the grinding of chip breakers (wheels ¼" and wider), and for many internal, cylindrical and surfacing jobs you'll find that Norton Vitrified diamond wheels can really cut costs.

Why? Because the vitrified type of bond, used so widely in other Norton wheels, gives a diamond wheel with these outstanding features: (1) a rigidity that gives dimensional accuracy to the work being ground, (2) a porous structure to promote faster and cooler cutting and (3) positive adhesion between the vitrified bond and the diamond grains which insure a long, useful wheel life. W-1190

The 138-page Norton handbook "Grinding Carbide Tools" is full of useful information. Write for a copy — no obligation.

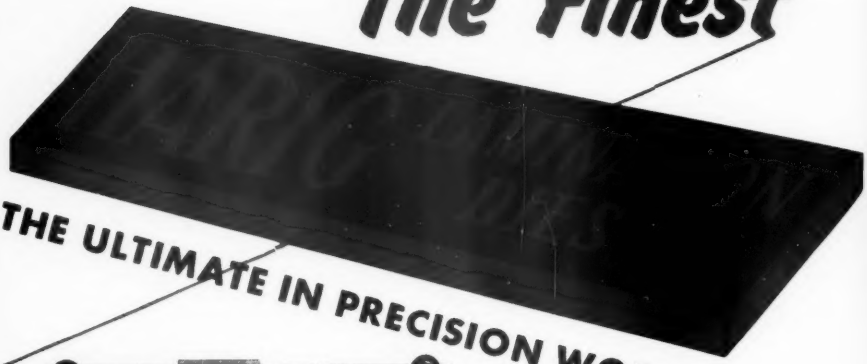
Norton Company, Worcester 6, Mass.
Distributors in All Principal Cities

Resinoid and Metal Bonds, too

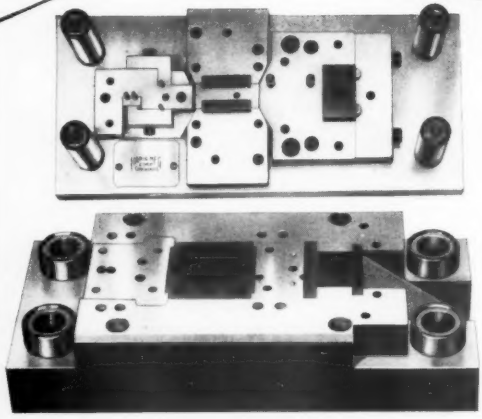
Because Norton Diamond Wheels are available in all three types of bonds you can be sure of getting the most economical wheel for each carbide grinding job—and impartial assistance from your Norton abrasive engineer or distributor.

YOUR PRODUCT DESERVES

The Finest



THE ULTIMATE IN PRECISION WORKMANSHIP



100 MILLION BLANKS

Have been produced from this CARBIDE Lamination Die with enough die life to produce Millions More

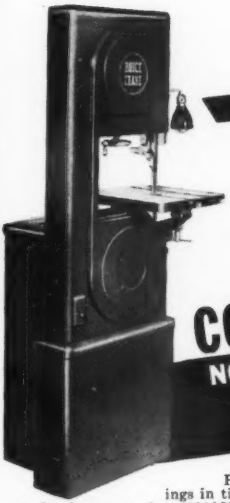
Section of Our 17,000 Sq. Ft. of Die Making Space. Illustration Shows a Portion of Surface Grinding Dept.

Also STAMPING DIES OF ALL TYPES JIGS, FIXTURES, GAUGES, SPECIAL MACHINE WORK

Your Inquiries Invited

HARIG

MANUFACTURING CORPORATION



Announcing

THE SENSATIONAL, NEW

BOICE-CRANE

ALL-PURPOSE, COMBINATION

CONTOUR SAW-BAND FILER

NOW EVERY SHOP CAN AFFORD EQUIPMENT FOR MODERN SHORT CUT CONTOUR MACHINING BY BAND SAW!

Permits amazing savings in time and money. Ups production as much as 1000%.

Maintenance and short run production parts; tools; metal templates; special wrenches and wrench templates; cams; spiral parts; irregular shape stacked parts; stamping, forming and trimming dies all produced in minutes instead of the hours required by old methods involving milling, shaping and hand filing.

Precision filing and file broaching to a layout finish line and flash removal in *one-ninth* the time required by hand and *one-fourth* the time required by reciprocating filing machine. Eliminates guesswork in angle filing.

The only combination Contour Saw and Band Filer with any one of 8 speeds instantly available up to 4100 blade f.p.m. for efficiently cutting wood, sponge rubber, masonite, etc.—and ranging down from there to a slow 92 blade f.p.m. A speed for cutting every metal and material like bar and sheet steel; steel, brass and aluminum tubing; hard rubber, transite, cast iron, plastics, bronze, synthetic glass; sheet asbestos; bakelite, and tool steel up to 1" thick, and for filing a variety of metals and other industrial materials. Wheel speed chart, for cutting all these and more, mounted right on machine.

Permits all the modern, high speed production techniques of inside, as well as outside, contour sawing.

Heavy, rigid, 10-gauge solid welded steel frame.

Specially designed guides sharply reduce blade costs. Handle blades $\frac{1}{8}$" to $\frac{3}{4}$" wide.

15" x 15" heavy ribbed cast work table, ground to close machine tool limits and mounted on two heavy cast trunnions.

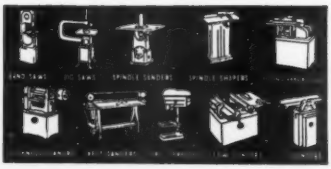
Enclosed Textolite disc wheels balanced for speeds in excess of 4100 blade f.p.m.

File bands are available for all purposes, in two widths, two shapes and six cuts. The file segments have exclusive, patented self-aligning ends which automatically lock to produce a continuous, rigid, flat surface.

Band Files in $\frac{1}{4}$", $\frac{3}{8}$" and $\frac{1}{2}$" widths, Flat and Oval, in a total of ten tooth styles to fit other make machines.

COMPACT • PORTABLE • ACCURATE • RUGGED • LOW COST

IDEAL FOR			
	TOOL AND DIE SHOPS	MILLWRIGHTING AND REPAIR SHOPS	MACHINE SHOPS
	TESTING LABORATORIES	PRINTING PLATE MANUFACTURING PLANTS	SCHOOLS
			INSTITUTIONS



Use Coupon To Get Free Literature

BOICE-CRANE COMPANY

963 Central Avenue • Toledo 6, Ohio

Please send free literature on the new Boice-Crane Combination Contour Saw-Band Filer.

Name_____

Firm _____

Street _____

City & State_____

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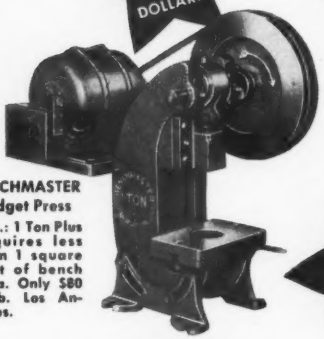
MORE TONNAGE PER DOLLAR!

BIGGER CHOICE OF SIZES!

BENCHMASTER PRESSES

LONG LIFE • PROVEN PERFORMANCE
LOW INVESTMENT • MORE FEATURES



BENCHMASTER
Midget Press
Cap.: 1 Ton Plus Requires less than 1 square foot of bench area. Only $80 f.o.b. Los Angeles.

WIDER CAPACITY RANGE!

Whether you punch, crimp, stamp, form, rivet, or assemble, you get the right press for the job in a Benchmaster . . . and do it with a minimum investment. Engineered for more life; quality built throughout; completely proven by thousands in use throughout the world.

BENCHMASTER
4 Ton Press
A regular power house for all conventional operations.

BENCHMASTER
4 Ton Deep Throat
Punches to the center of a 17½" circle.

For more features, greater safety, big economy, it's BENCHMASTER every time!

Write for circulars on all Benchmaster tools and accessories.

benchmaster
MANUFACTURING COMPANY
2952 WEST PICO BOULEVARD
LOS ANGELES 6, CALIFORNIA
benchmaster tools
WORLD'S LARGEST PRODUCER OF SMALL PUNCH PRESSES

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

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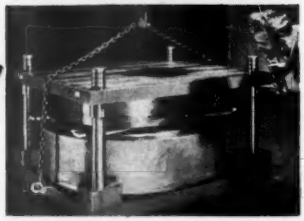

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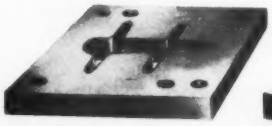

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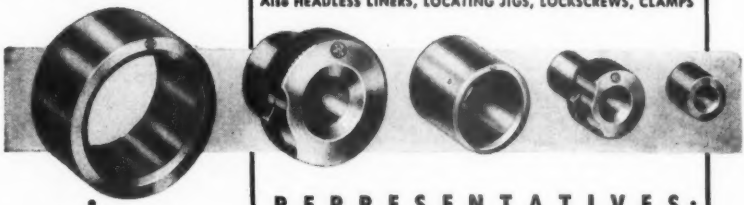

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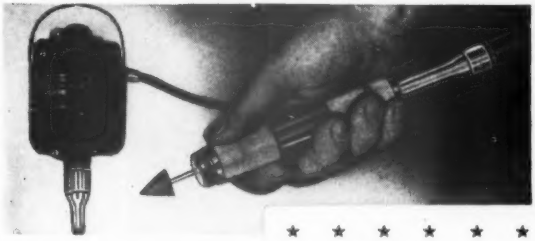

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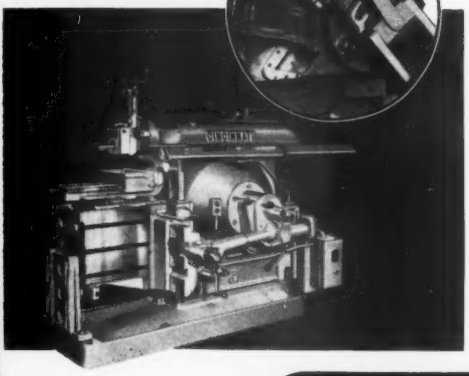

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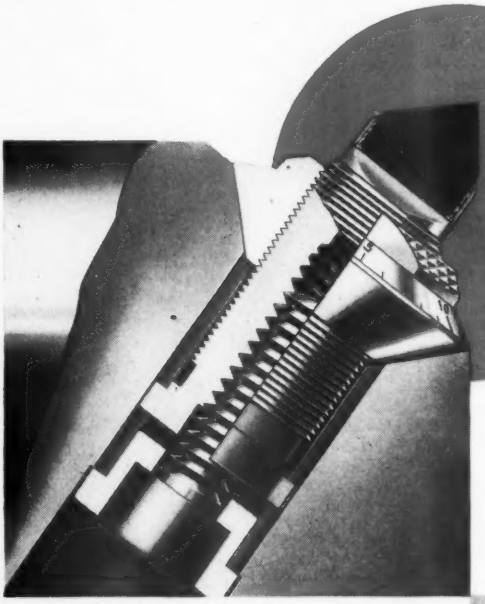

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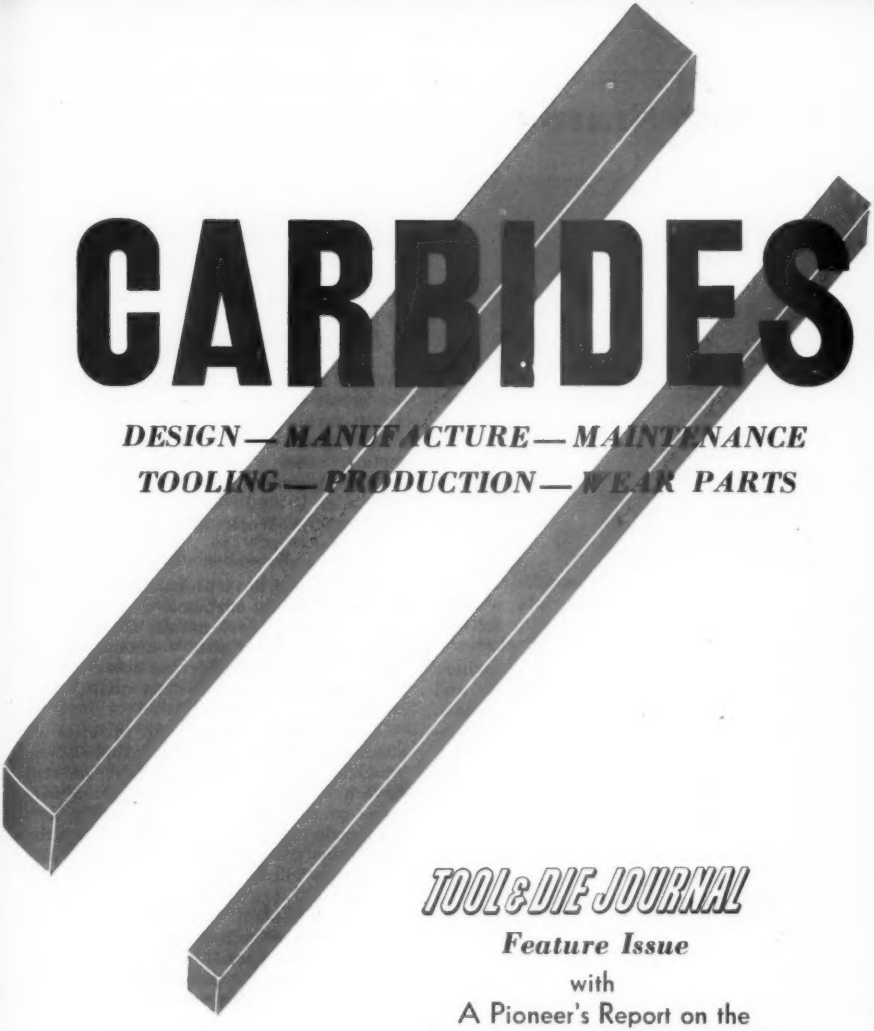

TOOL & DIE JOURNAL

Feature Issue

with

A Pioneer's Report on the
"Status of Carbides Today"

National Machine Tool Builders' Association executive's description of the "race between the cutting tool and the machine tool."

Metal Cutting Tool Institute's Research and Technical Committee's report on developments of and standards for Cutting Tools.

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The Status of Carbides Today

That January, 1950, should bring with it the first all-carbide issue of any technical or trade publication in this country is quite fitting. Five years ago—even two years ago or less, perhaps—such an issue, while undoubtedly interesting, could not have had the significance it has today.

Carbides Have Come of Age

After 20 years of struggle and experimentation, trials and errors, failures and successes, carbides have come of age. They are no longer "trick" or little-understood metals. They have taken their place alongside of iron and steel, tin and copper, as everyday materials without which we would have difficulty getting along in our modern industrial scheme.

Not that we have reached anywhere near the ultimate in knowing how and where we can use these ultra-hard metals. If that were so, there would be little reason for this issue. We are finding new uses for carbides daily, and also better ways of applying carbides to old uses. We are finding that applications we once thought would always be impossible are actually quite simple once we learn the trick of "how".

Shock Resistance

For example, the greatest recent technical advance in carbides probably is our new knowledge of how to use these supposedly "brittle" metals in all kinds of applications where ability to resist shock is a prime requisite.

This hard-won knowledge has opened up vast new fields to carbides, particularly in mining. Already carbides have established themselves definitely for rock-drills which do their drilling primarily by virtue of a hammering action. This development also makes the recently announced process of recovering oil from shale even more promising from an economic standpoint. Bits containing inserts of as much as 15 lbs. have been successfully employed on an experimental scale in percussion drills.

This has not come about as the result of any spectacular development in the carbide metals themselves. Rather it is the result of knowing more about how to apply carbides so that they will outperform other, theoretically less "brittle", metals under shock conditions. It has taken us years of continuous experimentation to find the answers but it was worth-while. We know how, today.

Wear Resistance

Actually we have probably gone ahead farther in using carbides to resist shock than in using these metals for machine parts to resist "wear"—anomalous as that may sound, considering how well and how long the wear-resisting qualities of carbides have been known.

Despite the hundreds of varieties of successful wear-resisting applications which are now widely accepted, we still have a lot to learn about applying carbides to such purposes. Yet, every new application brings us a little closer to the day when the use of carbides for wear-resistance will be taken for granted.

Blanking, Forming and Piercing

This is rapidly becoming the case already, for instance, in the field of sheet metal dies and punches, a field in which both shock and wear-resistance are important factors.

The phenomenal performances of carbides in this branch of metal-working are now rather well known and promise to revolutionize the entire art of metal drawing, blanking, forming and piercing. Undoubtedly we will see in the near future new types of stamping and drawing presses "designed for carbides" which will raise even further the performance levels attained to date.

In this respect the press field will probably follow the pattern of the ma-

chine tool industry, although the pace may be considerably faster. In the early days of carbides, we had to do "the best we could" in applying carbides to machine tools intended for use with high speed steel and even carbon steel tools. Even under these conditions, the results obtained were so striking that by the time of World War II machine manufacturers had modified their designs to permit the optional use of carbides.

Machines Built for Carbides

Today's newer machine tools, however, are again as far ahead of those developed just prior to World War II. It is hard to tell which is the most responsible for this development. Whether it was the war-production experience, whether it was the necessity of turning out peacetime products in enormous quantities after hostilities ceased, or whether it is the present drive for lower costs. Probably all three exerted their own influence. At any rate machine tool builders are now fully aware of the real possibilities and the real requirements of carbide tools. Today machines are being built *for* carbides and are being sold on the basis of over-all *carbide* performance. In the next few years even further advances in the machine tool field are among the likely developments. Some of these have already appeared on British machine tools, incidentally.

Fundamentally these developments are part and parcel of a psychological change, the effect of which is more far reaching than any single technical development. Industry no longer thinks in terms of "can we improve performance with carbide tools?" The attitude now is to base project performance on the assumption that carbide tools *will* be used unless there is some good reason for not using them.

An indication of the new attitude toward carbide tooling is in the spectacular successes of the "co-ordinated carbide control" plans which have been put into effect by numerous companies.

These plans have had an important influence on practically every phase of manufacturing—increasing productivity per machine hour, reducing non-productive machine idle time, reducing tool maintenance, cutting inventories and even capital investment—all adding up to increased efficiency and lower cost of the finished product.

Presenting the author of
"The Status of Carbides Today"

W. G. Robbins
President
Carboloy Company, Inc.
Detroit, Mich.

Everyday Tools

This change in attitude has been accompanied by a virtual revolution in the tool industry. One by one the important old-line tool manufacturers have been swinging over to the carbide tool fields. There is hardly a tool type made of steel a few years ago which is not available in carbide form today. It isn't very far back when applications of some of these tools were considered "stunt" jobs. They are that no longer. They have become everyday tools on everyday jobs.

It is hard to believe after all the years that carbides have been with us that so important a transformation is taking—or rather, has taken—place. Its importance is illustrated by the reversal in tool

(*Continued on page 102*)

Carbide Tool Design for Freedom from Brazing Stress

by Malcolm F. Judkins
Chief Engineer
Carbide Division
Firth Sterling Steel & Carbide Corp.
McKeesport, Pa.

Sintered carbides are being currently used on single point tools for roughing in such machines as lathes, planers, and boring mills and for finishing on such operations as precision boring, forming and threading. Multiple point tools use carbides for such roughing operations as milling, boring and hobbing, while finishing operations involve, in addition, reaming.

The materials which are now machined with carbide tools cover cast iron and steel of all types, non-ferrous and non-metallic materials of virtually every kind.

Abrasion and Shock Resistance

In addition to cutting operations, carbides are finding increasing use in applications requiring a high order of resistance to abrasion, such as the drawing of rod, wire and tubing, as well as both sinking and extruding of metal and plastic tubes and sheets. Sintered carbide has also invaded fields of use which require great strength and resistance to shock and impact. Typical of this type of application are cold heading and extrusion of such products as cap screws and machine bolts in sizes up to ¾" diameter, and the punching, blanking, shearing, piercing and forming of sheet metals with carbide punches and dies.

There is a very evident trend toward harder, tougher and more abrasive materials being cut and formed. This is exemplified by the development of special high alloy materials for jet and rocket propelled aircraft, as well as a remarkable increase in the extent of use of stainless steels for both structural and mechanical purposes. There is a very marked tendency on the part of industry to minimize the labor ingredient in production and manufacturing costs by a continual increase in speeds and feeds. This change is also reflected in the development of more nearly automatic machines.

Automatic Machines

More and more repetitive parts are being mass produced on multiple station indexing machines of both the chucking and bar types. Typical parts being so produced are automotive bevel gear pinions, clutch plates and ball bearing races. The transfer machine which was developed during the last war, particularly for aircraft engine cylinder production, is now a familiar sight in most of the larger automotive plants producing such parts as passenger car and truck axles, as well as rear axle housings and differential cases. The recent introduction of the turn milling process has done much to increase the production rate and reduce the production cost of automotive crankshaft forgings.

All of these recent development in machining and metal forming techniques have compelled the evolution of new and more efficient grades of sintered carbide. Among these requisites are strength and toughness for roughing and interrupted cuts, a higher degree of crater resistance for machining the softer steels and harder and more wear resistant grades for heat treated and work harding steels and alloys, abrasive irons, non-ferrous and non-metallic materials.

The Brazing Problem

It is inevitable that these improved and highly productive grades should pose a serious brazing problem. It is required to permanently join the carbide tip to its supporting steel shank *tightly* enough to prevent dislodgment by resisting fatigue from the impact of interrupted cuts, resisting extrusion under heavy chip loads and resisting softing at high temperatures. The tip must be brazed to the shank *loosely* enough, however, to prevent cracking when the tip or shank section changes abruptly due to the design of the tool or the work to be done and as a further result of brazing, grinding or use.

The causes of brazing stresses have a common origin. The liner coefficient of thermal expansion of most grades of carbide is only about half of that of the steel customarily used for shanks. Figure 1 illustrates a typical example. A relatively

long, thin and narrow carbide tip is to be brazed to a wide, thin shank. During heating from room temperature to slightly above the melting point of the brazing material, the steel expands roughly twice as much as the carbide, but since the tip

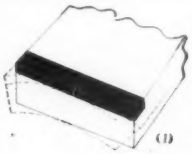

Fig. 1. Dotted lines indicate deformation of shank during braze heating cycle. Normal recovery of both tip and shank is prevented by strength of braze.

is merely resting in the shank recess, the relative motion between the two, consequent upon the differing expansion rates of the two materials, does no real damage. After the braze has melted and flowed into the space between tip and shank, however, the heating is discontinued and after cooling to the melting point of the brazing material, the tip and shank are joined more or less rigidly together. From this relatively high temperature down to room temperature, the steel, which was distended twice as much as the carbide, endeavors to return to its original size. In so doing, tensile and buckling strains result, which frequently crack or rupture the carbide.

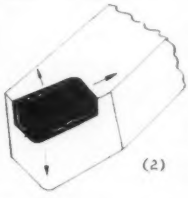

Fig. 2. This pocket recessed tool presents a great restriction to the contraction forces as the two materials cool down after brazing. The resultant three-way stretch will crack the carbide.

Figure 2 presents the conditions which obtain after brazing the carbide tip into a so-called "pocket recess" in the shank. Notice, in this instance, the contraction of the steel takes place in the three coordinate planes, which results in a three-way tension or pull upon the carbide and frequently cracks of the type illustrated result. The identification of these as brazing cracks is relatively easy because they are usually located sensibly parallel to and close to the brazed joint.

Figure 3 illustrates still another type of brazing problem resulting from a highly irregular shank and tip section, caused by the cutting edge contour required to form V-belt sheaves.

Figure 4 depicts a vertical form tool with a very deep tip, so designed as to provide many regrinds parallel to the original surface of the top or face of the tool. Unfortunately, such a long tip as this will often crack, as indicated, when the steel shrinks from the brazing temperature.

Frequently, vertical form tools must be made with L-shaped cutting edges, as shown in Figure 5. On cooling from brazing, the 90° V will tend to spread and the tip will often crack at the vertex, as indicated.

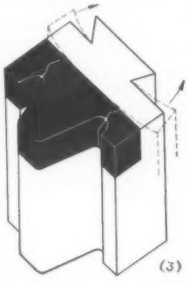

Fig. 3. This dovetail form tool for machining V-belt sheave grooves represents the design weakness resulting from highly irregular tip and shank sections. The relatively thin steel section back of tip will distort and crack the tip at its weakest points.

For economy of carbide on pointed nose tools which must cut in both directions, the tip is occasionally brazed into a central slot or recess, as shown in Figure 6. The contraction of the thin steel sections on each side of the tip may cause cracks, as shown. A tool like that shown in Figure 7 is used to smooth the bore and form the bell radius of railway car brasses. The rapidly changing section of the tip and shank, inevitable with this design, may easily cause a crack at the location indicated.

If we must eliminate brazing stress entirely, the simplest method is to remove the cause and hold the tip mechanically, as shown in Figure 8. In such a case, there is no heating for brazing during manufacture and consequently, no expansion. Furthermore, there is no cooling from the braze and, therefore, no contraction. There is no really rigid union between the tip and shank and, therefore, no thermal stress is developed. Relative movement between tip

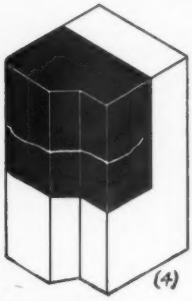

Fig. 4. This vertical form tool was designed with a particularly deep tip in order to provide a tool that could be reground many times. Such a tip is subject to transverse cracking as indicated when the steel shrinks after brazing. Cracking is most apt to occur half way down the tip.

and shank is unconstrained, as both are heated and cooled in service. This would seem like a complete solution to the problem at this point but, unfortunately, the Mechanigript design is not always feasible.

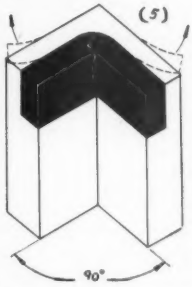

Fig. 5. The L-shaped vertical form tool represents a common design. As shown, the 90°V is a critical dimension and is also the weak point of the tool. Dotted lines represent warpage upon cooling as the thin steel sections pull away from the carbide; hence the crack.

Mechanical holding of carbide has certain limitations and disadvantages. In many cases, this design is costlier to make and maintain. The inherent negative rake, which can only be overcome by extensive chip groove grinding, is often a detriment. Negative rake should really only be employed when the tool would otherwise fail by edge failure due, for example, to the very heavy cutting pressures encountered under very heavy cuts and feeds, such as planing, or the impact resulting from interrupted cuts. Where negative rake is unnecessary to strengthen the cutting edge, it results in greater power consumption, more work harding of the surface being machined and particularly in the case of the softer steels, accelerate cratering of the tool face.

Fig. 7. This tool smooths the bore and forms the bell radius of railway car brasses. Its extreme variations in section may cause warpage cracks.

On many free cutting steels, the negative rake compresses and collapses the chip, increasing the size of the built up edge and actually induces early tool failure through cratering and flank wear. Many of the Mechanigript designs, notably those mounting round or triangular inserts, are limited to relatively light cuts and feeds. Heavy loads may cause failure through jamming of the insert, making it impossible to index or adjust after the cutting point in use becomes dull or broken. Occasionally, the chip action damages the holder, making it unsuitable for further use and in some instances, shank failure occurs due to the insert tearing out the thin section at the side or in the front. Furthermore, the Mechanigript shape is frequently inconvenient, since it is impossible to insert the tools from the rear of the tool block and the nose width on many styles precludes the

(*Continued on page 102*)

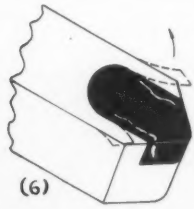

Fig. 6. Pointed nose tools commonly have a confining recess into which the tip is brazed. As the thin, enclosing steel sections warp away from the carbide the tip is likely to crack as indicated.

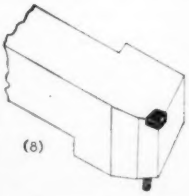

Fig. 8. By holding the tip mechanically, tip and shank are unconstrained during their heating and cooling in service. But mechanical holding, seemingly a complete solution, is not always feasible.

Turning with Solid Carbide Inserts

Since the advent of carbide-tipped turning tools many ideas have been tried in order to improve cutting performance and overcome some of the more prominent restrictions of single-point, brazed-type tools.

In an attempt to further improve the general application of carbide metal turning tools, a completely new line of holders for mechanically securing solid carbide inserts, has been designed. These holders not only cover the general applications of tools with brazed tips, but also a large number of jobs that were too rough, such as heavy interrupted cuts.

by Milton J. Steffes
Research Engineer
Super Tool Company
Detroit, Michigan

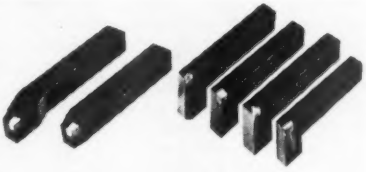

Fig. 1. Six tool holder styles for solid carbide inserts. The several manufacturers of the vertical and horizontal designs shown have standardized on the sizes and shapes of the inserts.

In short, a large percentage of turning applications that were, in the past, unsuitable for carbide-tipped tools, are now being efficiently machined by a properly adapted insert and holder. The advantages to be gained by using solid carbide inserts, mechanically held, for turning operations are becoming widely recognized.

There are many methods of holding these inserts but the most commonly used are the vertical and horizontal designs shown in Figure 1. The various manufacturers of these vertical (ejector type) holders have standardized on the sizes and shapes of the inserts used, to triangular, square, round and rectangular, all 1½" long. This allows the users a wide selection of tungsten carbide brands

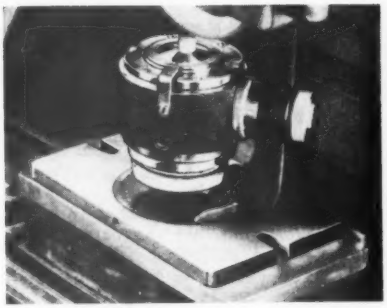

Fig. 2. With this versatile fixture, suitable chip breakers can be ground on any style of standard carbide insert.

from which to select.

The vertical method of holding the inserts is the most economical method yet devised. The round, rectangular and square types are used for general roughing and semi-finishing, depending on whether the cut is made to a shoulder or chamfer. The triangular type is used primarily for finishing and plunge cuts but can be easily adapted to a rough or semi-finish cut where one or all of the other three types do not adapt readily.

Inserts are standardized at a length of 1½" and are so located in the overhang portion of the holder as to permit both easy rotation to a new cutting radius and removal for regrinding.

Thus, the merits of this mechanically

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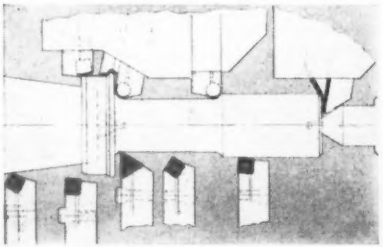
Fig. 3. The vertical holder is best applicable to production setups involving several tools. Symmetrical shape of inserts brings new cutting edges to the work without resetting the tools.



Carbides as a Challenge to Machine Tool Builders

We ordinarily conceive of the *machine* tool as the machine which cuts and shapes metal; and the *cutting* tool as one of the accessories furnished by the tool room along with other attachments necessary for the job.

The fact is, of course, that it is not the machine tool, but the cutting tool, that cuts and shapes the metal.

All the machine tool does is *apply the cutting tool in the right way.*

It is difficult to explain to, let us say, a high school class, when showing them a turret lathe, for example, that the sole purpose of that intricate mechanism is that of presenting the cutting tool to the work in such a way as to take best advantage of the cutting tool's potentialities.

Such, nevertheless, is the case; and it is interesting, therefore, to consider machine tool design in the light of the challenge which advances in cutting tools have presented to the industry.

In the beginning, of course, the very invention of machine tools was dependent upon the development of a tool hard enough to cut metal.

From that point on, the history of metalworking has been a continuous race between the cutting tool and the machine tool.

As fast as a better cutting tool was perfected, machine tool builders hastened to redesign their models in line with its possibilities.

While some machine tool builders may, on paper, have designed models calling for better cutting tools than any as yet in existence, they are practical people, and building machines costs money. So in actual practice it has been cutting tools that have set the pace—with machine tool redesign founded largely upon progress in cutting tool improvement.

The biggest recent impetus in machine tool building from the above standpoint may, therefore, be said to be the advent of cemented tungsten carbide cutting tools. In the period preceding the last war there was an interesting competitive struggle between high-speed steel tools and carbides—but wartime experience definitely left the latter in the supremacy. In fact, machine tool redesign today might well be interpreted as the continuing effort to capitalize in full the advances indicated by today's carbide cutting tools.

The problems involved encompass practically every phase of machine tool manufacture and design. For example:

Strength and Rigidity

Modern carbide tools make possible faster speeds and feeds. But to take these speeds and feeds, the machine tool must be a much more sturdy mechanism than ever before. Stresses and strains must be carefully calculated, vibrations eliminated, and accuracy maintained at a rate of operation above all previous experience.

This factor calls for a type of engineering ingenuity that in older days was unnecessary. Too much weight is undesirable and costly. How can strength and rigidity be achieved without adding unduly to weight?

The new postwar models on exhibit at the last Machine Tool Show, and others developed since, display amazing progress in this direction.

Controls

The high speeds which can be used on some jobs when cemented carbide tools are applied require a very great speed range at the spindle. Not only must bearings be found to withstand the feed pressure of the tool when coarse feeds are used but also to operate at high speeds without breaking down. It is also necessary to furnish a rather large and expensive gear box to secure wider speed ranges at the drive motor. Electronic control has in many cases proved to be the answer. With the growth of experience it is to be hoped that stand-

by Tell Berna
General Manager
National Machine Tool Builders' Association
Cleveland, Ohio

ardization of electronic drives will reduce their cost. In the meantime we may have a wide speed range in imperceptible increments and relatively constant speed characteristics under variable loads, and the control is sturdy and not hard to maintain.

Bearings

Smooth operation at higher speeds and feeds requires bearings capable of a performance never demanded in past years. This, in turn, is constantly stimulating research and development among the bearing manufacturers. When the demand for accuracy to tolerances of as high as five ten-thousandths of an inch is combined with the demand for high speed, bearings become a critical factor.

Lubrication and Cutting Oils

One of today's major problems is far greater heat generated by higher feeds and speeds. This has been a problem not only for machine tool builders but for the manufacturers of cutting tools themselves. The solution of this problem, like that of lubrication under today's conditions, has proved a subject of study, not only for machine tool builders but for the petroleum industry. So, today in petroleum research laboratories experiments are constantly being conducted in this field.

Simplification

Amazing possibilities are being opened up as means are devised for speeding removal of metal. What this does is, of course, to increase the metalcutting capacity and the flexibility of the individual machine. In some cases, therefore, it now becomes possible to perform on a few individual standard-purpose machines what formerly has been done by a series of operations in sequence on special machines. As various competitive designs materialize, this factor may have an interesting bearing upon the relationship between the special-purpose and the standard machine.

Widening the scope of the general-purpose machine tool is of great value to the small shop, or any shop with short runs. After all, every shop can't hope to indulge in "mass production". The average American metalworking plant is a small establishment, with say 96 employees. It is interchangeable manufacture and the ability to change over quickly from one short run to another, that must be the basis of our continuing progress in this field.

Serving the Machine Tool

The continuing reduction of the time required to cut away metal brings into greater prominence the importance of saving time in other parts of the cycle. In many cases it takes longer to load the piece than to take the cut. There is room for substantial improvement in methods of loading, unloading and gaging on many jobs.

Furthermore, the development of really effective teamwork between stock handlers, tool room men and the machine operator becomes more important. Much "down-time" on the machine is not the fault of the operator of the machine but is due to failure of auxiliary services.

Since we are manufacturing chips much faster, we also need to provide for more frequent chip removel, and to do it without stopping the machine.

Steels

The desire for greater strength and rigidity plus minimum of weight presents a problem not only to engineers of the machine tool industry but to the makers of steel. In this field it takes the form chiefly of experimentation with new alloys. Certainly without the alloys available today many current machine tool models would be impossible.

The Human Factor

All of these developments a g a i n accentuate a long-time trend in American shops. The operator is not a portable power plant. He is not a form of hoist. We use him as a guiding intelligence, not as a source of power. We have made his work simpler and safer but we have

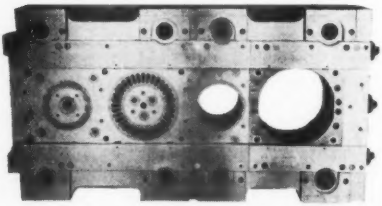
(Continued on page 138)

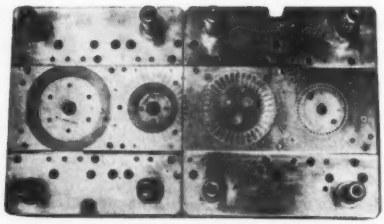
Remarkable Records

by Guy Shingledecker
Manager, Laminations Department
Allegheny Ludlum Steel Corporation
Pittsburgh, Pennsylvania

We at the Laminations Department had long realized the possibilities of using tungsten carbide in the manufacture of lamination dies, and when our company purchased the Carbide Alloys Corporation of New York in 1943, we had a real opportunity to put our thoughts to work.

We feel that our company is a natural for the development of these metals, since we make our own high carbon, high chrome die steel as well as our own tungsten carbide. We build our own dies, operate our own press room and produce our own sheet and coils in all gages and grades for the production of our orders. The Carbide Division was moved to its present location in Detroit in 1944. Several design engineers from our department were assigned to Detroit to assist their engineers in developing the production of die parts.





This Carmet four-stage progressive rotor and stator die is largest ever made. Hole and slot stations are made in pie segments.

This division today is producing and sintering parts to closer dimensions than most other tungsten carbide producers. Their engineers have developed grades ranging from Carmet C.A. 1 to C.A. 20 and there are grades suitable for almost every application. Our first efforts in applying Carmet to lamination dies were in the form of brazing or silver-soldering of small pieces for the cutting edge to our Huron and other grades of steel.

This did not prove successful since the intermittent shock of the punch on the die would cause the braze to fail. We then decided the cost of Carmet should not stand in our way and we started our experiments with solid sections.

Our previous experience in the manufacture of dies had taught us that the cost of the die steel used in a die was an unimportant factor since, in the building of a rotor and stator die at the total cost of $14,000, the Huron die steel used would amount to only $200 to $300. The cost of Carmet for this same die would be about $2,000, while the finished cost of this same die with all solid Carmet sections would be approximately $35,000. This proved that the material used in any die is a small factor in the cost, the main factor being labor.

Various methods for holding these Carmet sections in the die were tried, such as putting a tapered hole in the Carmet section and inserting a soft tapered plug, which was drilled and tapped to receive a screw.

This method was discarded because of its tendency to split the section. Various other methods were tried and discarded and we finally arrived at our present method, which consists of counterboring the section to within ⅛" of the bottom and inserting a round plug drilled and

E-LAMINATION DIE

Comparison No. 1

	Carmet Die	Huron Punch
Production	5,900,959	5,900,959
Grinds	6	81
Pieces per Grind	983,493	72,851
Depleted	.046	.748
Pieces per .001	128,281	7,888

Die Maintenance

	Carmet Die Huron Punch	Huron Die Huron Punch
Production	5,900,959	7,913,947
Die maintenance	$60.66	$183.85
Maintenance per M	$.0103	$.023
Savings per M	$.0127	

Charts (2):

E-LAMINATION DIE

Comparison No. 2

	Huron Die	Carmet Punch
Production	3,772,610	3,772,610
Grinds	54	8
Pieces per Grind	69,863	471,500
Depletion	.375	.052
Pieces per .001 life	10,060	72,550

Die Maintenance

	Huron Die Carmet Punch	Huron Die Huron Punch
Production	3,772,610	8,359,775
Condition of Die	Still running	Worn out
Die Maintenance	$103.16	$780.56
Maintenance per M	$.027	$.093
Savings per M	$.066	

E-I 12 LAMINATION DIE

Comparison No. 3

	Carmet Die Carmet Punch	Huron Die Huron Punch
Die thickness new	1.000″	1.259″
Total Die life (scrap at .200)	.800″	1.059″
Production to 9-1-48	14,307,215	3,858,000
Condition of Die	Still running	Worn out
Amount ground from Die	.347	1.113
Pairs per .001-Die Life	41,231	3,466
Die Cost	$8277.82	$2,500.00
Cost per M. Pairs Die	$.251	$.648
Pieces per Hour	9,197	4,995
No. of grinds	58	150
Pieces per grind	246,676	25,720

tapped to receive a screw. On small sections, shoulders are provided to hold these sections in the die. In some cases, a force fit is sufficient to hold the sections, while in others a shrink fit can be used.

The punches are secured to a steel base by such means as a dove tail design and by slots in each Carmet punch inserted in a ring and the ring secured to the punch holder.

We have in operation at the present time approximately 35 Carmet lamination dies and at least 10 drawing dies.

On our lamination dies, an elaborate record was kept not only of die costs but of maintenance costs and of production from the dies. Further on, we will give examples of the above showing the pieces per grind. The actual life of a Carmet die is difficult to discuss, since we have yet to wear one out!

In order to prove conclusively to ourselves the advantage of Carmet over high carbon, high chrome steels used in dies, we built a die of Carmet and the punch of Huron. Then we reversed this procedure, building a die of Huron and the punch of Carmet.

All our comparisons will be made on dies operating on 29 gauge, 4½ to 4¾% silicon steel. This steel is extremely hard to fabricate due to the brittleness caused by the high silicon and the extremely high abrasive qualities. You will note that most of our experiments have been conducted with this grade. We felt that if a success could be made with this grade, *any grade* could be fabricated with even better results.

A highlight to remember in fabricating this grade and gage of steel is that the average pieces per grind on any high carbon, high chrome die is not over 30 to 40M strokes.

Our next comparison shows the same shape but with the die member made from Huron and the punch made from Carmet, producing the same gage and grade.

Our next comparison is on our E-I 12 lamination as shown in our catalog. This is the 1″ standard scrapless, producing the same gage and grade. We have built and worn out many dies for this shape from the high carbon, high

chrome grade, and some of the figures listed for this steel die are the average.

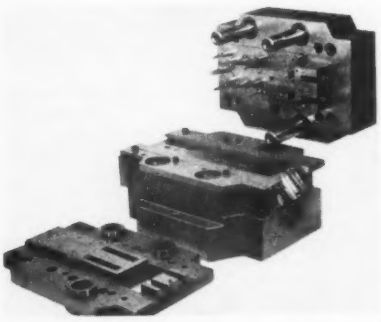
You will note in this comparison we started with only 1" of die plate. This has now been standardized at 1.25", the same as all our steel dies. You will note the cost of the Carmet die is 3⅓ times the cost of a steel die. A good average figure to use as a cost of a Carmet die is 3 times the cost of a steel die.

Note the tremendous saving in cost per M pairs on this particular gage and grade. Most other grades will not show this saving, since on the lower grades the life of a steel die is better than twice the amount shown for this grade.

The big saving, however, is really in the pieces per hour, which means that the die is in the press and operating instead of at the sharpening bench.

While tungsten carbide's performance on the die press is revolutionary in the production of pieces well in the millions, it should be remembered that high carbon, high chrome die steels continue to be the generally accepted materials for use in the production of smaller quantities of laminations.

There are many things that could be written pertaining to the tolerances of our dies, the clearance between the punch and die, the angular clearance or relief in the die, and the recommended time to remove a die from the press even though the burr has not reached our burr limit. For lowest die cost per pound of finished laminations, it has been found desirable to maintain the following burr inspection limits as a basis of the best die grinding practice.



When last checked, this Carmet scrapless punch and die had produced over 14 million E-type laminations. Huron die had worn out at 3,858,000 pieces. Carmet die produced 246,676 pieces per grind.

One of A.L.'s 25-ton presses in action, punching E-laminations from Carmet die.

Gauge	Burr Limit
29	.002
26	.0025
24	.003
22	.0035

This procedure will result in less die steel removal per grind, and the longest possible die life, while producing the highest quality of magnetic core laminations.

This will not hold true in all runs from a die, especially if made from Carmet. As an example, because of our curiosity to see how long a Carmet die would run, we operated our E-I 11 or ⅞" scrapless die on coil stock, 24 gauge, 2½% silicon content to 2,300,000 strokes and the burr on the lamination was only .0015, whereby, as you see above, we recommend .003. We found the laminations getting tight in the die and removed it from the press for examination. The die had started to bell mouth, and of course when this happens, enough stock must be removed from the die to clean up this bell mouth condition, which in this case was .010.

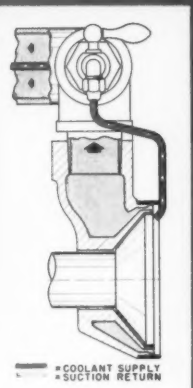
Had this die been removed from the press at say 1,000,000 strokes, it could have been sharpened by the removal of not over .003. This proves that long runs are not the entire answer.

There are many other uses for Carmet other than for the cutting edge of a die.

(*Continued on page 96*)

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

New Mist Type Coolant Equipment attached to CINCINNATI No. 2 Cutter and Tool Grinder. Complete details are contained in catalog M-1672.



Sectional drawing shows how the Mist Type Coolant Equipment takes the coolant on a round trip to the grinding wheel and return.

Combines Advantages of Wet and Dry Grinding . . .

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FOR SINTERED CARBIDE CUTTERS

Coolant is good for diamond wheels . . . it prolongs their life. And it produces a better surface finish on the work. But, until recently, wet grinding of carbide cutters was a messy, disagreeable job for the operator. This objection is overcome, and all the advantages of wet and dry grinding are retained by using the Mist Type Coolant System on CINCINNATI No. 2 Cutter and Tool Grinders. This attachment is completely self-contained. A small diameter tube within the large flexible tube supplies a thin stream of coolant to the wheel. Upon contacting the rapidly rotating wheel, the coolant is transformed into a mist. The suction fan returns it through the wheel guard and tube to the coolant tank. Thus the grinding operation is wet . . . the work, machine and operator are dry. ¶ With this equipment you can grind sintered carbide cutters quickly and efficiently. Additional data contained in catalog M-1672. May we send you a copy?

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Carbide in Gage Manufacture

Increased utilization of the cemented carbides in metalworking plants has been extremely important in the success of recent efforts to reduce production costs. Perhaps the most publicized results of carbide applications have been obtained in the field of metal cutting, where under many circumstances certain carbide tools have been found to out-produce ordinary hardened steel tools consistently.

by **F. Steele Blackall, III**
Assistant Superintendent
Small Tool Division
The Taft-Peirce Manufacturing Company
Woonsocket, Rhode Island

However, this is just one of the more sensational uses of carbides. Equally important to the reduction of production costs are the lower inspection costs frequently made possible by the employment of carbides for the manufacture of gages. It is, of course, the long-wearing characteristics of the carbides that have led to their adoption as a gage material. It has been substantiated that ultimate gage life can be increased over fifty times by the use of carbides, and at a cost of perhaps four times that of ordinary hardened steel gages. Manufacturers of products requiring careful dimensional control have found carbide gages virtually obligatory in

(1) the continuous inspection of large quantities of parts;

(2) the inspection of finished parts, which are to be held to such close tolerances that the use of any part of the product tolerance as a wear allowance is impossible;

(3) the inspection of parts manufactured from highly abrasive materials, which cause ordinary hardened steel gages to wear down rapidly;

(4) the inspection of parts during operations, such as grinding or lapping, where complete removal of abrasive particles from surfaces is difficult or impossible before application of the gage.

In each of these cases, fixed inspection costs can be reduced markedly by minimizing the frequency of gage replacement.

Realizing that the price of carbides is substantially higher than that of steel, gage manufacturers have made every effort to minimize the amount of these materials actually used. To accomplish this, carbide bushings or inserts, cemented or brazed to hardened steel, are employed wherever economical, so that the material element of production costs will not inflate the selling price of the gage unnecessarily and the economy of carbide gages can be maintained.

Perhaps the single disadvantage of carbide gages has been their great brittleness. Because of it, more than usual care must be taken in handling and storing them. Certain of the carbides have been so brittle as to be impractical for gage use, while what others have lacked in brittleness, they have also lacked in wear resistance. The best balance has been obtained consistently with tungsten carbide and boron carbide, and for that reason, they have displaced others as a gage material.

Just as carbide tools are no panacea for metal cutting, neither should carbide gages be employed without considerable forethought; but a thorough familiarity with the relative advantages and disadvantages created by their use is imperative in order to achieve optimum efficiency in any gaging application.

Industrial Arts Training in Carbide Tools

A new course on carbide tools specifically designed for industrial arts curricula has been announced by Carboloy Co., Inc., Detroit, Mich. The course thoroughly covers the design, selection, use and maintenance of cemented carbide tools.

All necessary material, such as student work sheets, instructors' kits and workplans, visual and "home-study" material is included with the course.

This Carboloy course, available to schools without charge, is suitable as a supplement to present courses. The course is entirely new. It presents a new practical approach by industry to help school curricula keep abreast of major changes in carbide tools.

Complete details can be obtained by writing to Carboloy Co., Inc., Detroit 32, Mich.

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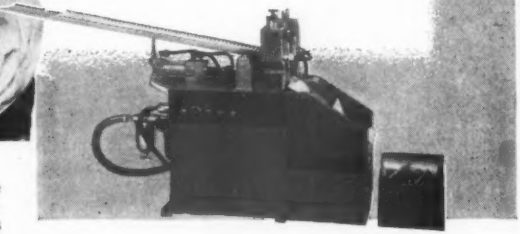
▲

This single-motor, compact machine automatically gages and sorts anti-friction bearing rolls. It rejects rolls above or below mfg. tolerance and separates accepted rolls into 5 sized categories, in increments of .00002".



▲

This machine gages and sorts straight sleeves into four categories — measuring for length as well as diameter at both ends. Its production rate is approximately 3000 per hour.

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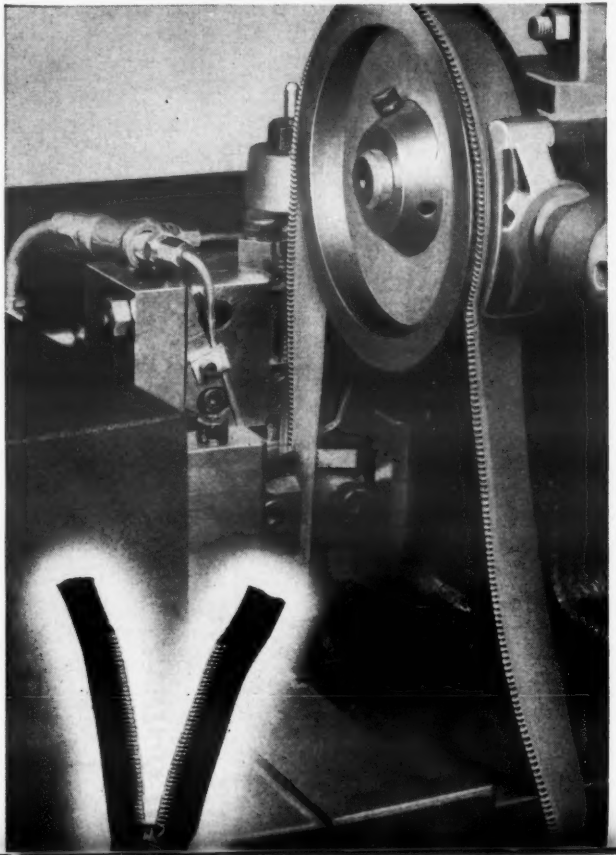
Carboloy dies put added zip in zipper production



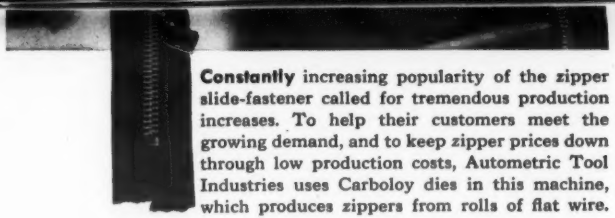
Here's a case history that proves the effectiveness of Carboloy Cemented Carbide in speeding up production and cutting down-time.

Read it; then eye your own production. Where can you take advantage of the same outstanding qualities to increase *your* output?

Thanks to the super-hardness of this amazing metal, zipper manufacturers—using the same machines—*doubled their* production . . . and that's not all:

They increased tool life 20 to one!

machines—*doubled their* production . . . and that's not all:



Constantly increasing popularity of the zipper slide-fastener called for tremendous production increases. To help their customers meet the growing demand, and to keep zipper prices down through low production costs, Autometric Tool Industries uses Carboloy dies in this machine, which produces zippers from rolls of flat wire.

They increased tool life 20 to one!

Prewar output, with side coining dies and "fingers" of the highest grade of alloy steel available, was about 115 yards of zipper chain per minute. With Carboloy sheet metal dies and "fingers", it's now 230 yards a minute!

Such applications of Carboloy Cemented Carbide commonly pay for themselves, in speeded-up production, within a very short time . . . often before the carbide dies or parts even begin to show signs of wear!

Certainly there are places in your production, or in your machines, where you—or your customers—could benefit equally from reduced wear. Blanking, forming, or cupping dies of Carboloy could easily increase your production, improve finishes, cut down the number of rejects, reduce down-time.

Worth looking into, isn't it? Give your Carboloy representative a call, soon. Or get in touch with us, direct.

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Carbide Success = Time + Persistence × Experimentation

Carbides and their uses in cutting metal present a fascinating future— a future that will be the result of a great deal of experimentation. trial and error, persistence and time. The advancement in carbide uses to date indicates that it may be even more of a factor in cutting metal than we anticipate at present.

In the fields of die sinking, mold making and in many forms of duplicating such as is done on Gorton Pantographs and Duplicators, carbides have already become standardized as cutting tools for certain types of work. At the same time, it is true that present carbides are not a cure-all. More research is necessary in both carbide manufacture and use.

by **Ira R. Ogilvie**
George Gorton Machine Company
Racine, Wisconsin

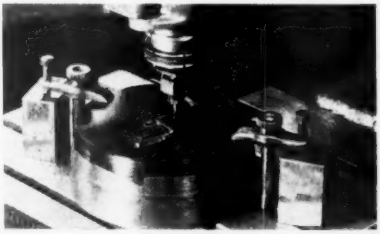
Pantographs and Duplicators, when operated manually, must employ relatively small diameter cutters—seldom more than one inch in the case of Duplicators or ⅝ or ½ inch in the case of Pantographs. These small cutters, aided by spindle speeds from 10 to as high as 40,000 rpm, permit the use of either solid carbide or carbide-tipped cutters in a variety of styles.

Particularly in high alloy steels such as used in hobs and dies, which may have the deceptive characteristics of a low Rockwell reading, and yet zero machinability due to toughness and the evil trait of work hardening, carbides of proper grade, design and lapped finish, not only save jobs but effect profits.

Almost anyone who reads this brief discourse on carbides has formed an opinion one way or another, through either direct or indirect emplovemnt of this material. This opinion may have been influenced to a great extent by improper handling, if it is negative, and, if positive, by sheer luck in acquiring what it takes to develop one hundred per cent successful operation. Frequently conditions arise and develop in such a manner that it is often best to withhold an opinion until all factors are gathered, weighed and considered, at which time the end results determine if carbide is the acceptable material to use or not. An interesting but fundamentally simple formula for the proper employment of carbides could be this: Time + Persistence × Experimentation = Success.

A short but true story of the machining and engraving of glass exemplifies this. For obvious but well understood reasons, diamonds have for many years been used in working with glass although their life between lappings is short; consequently, this has always been an expensive operation at best. After more than a vear of study and considerable experimental work, it has been found that ordinary carbide with the help of a proper lubricant will cut into and machine glass far better than diamonds ever did and within much less time. Cuts of .005″ and .010″ in depth at one pass are common, whereas diamond tools had a tendency to fail if forced to depths greater than .003″. The finish left by carbide is comparable to a ground frosted surface without any sign of fracture, chipping, or cratering. From early but not conclusive tests, it is found that the life of carbide for this work is exceedingly good, far surpassing a diamond tool regardless of the number of facets and cutting angles. Single and multiple-sided solid carbide cutters of various sizes, angles and shapes produced the same results as to appearance in finish and life of the cutter.

Here, too, one must withhold final judgment until time will allow sufficient data to be accumulated on this new usage with the aid of a special lubricant. Even diamonds, the hardest of all cutting tools, fail, but with the proper aid carbides do not, and are much less expensive to handle. Most important, they do a far better job than was originally anticipated.



On the Gorton, 2-dimensional Pantograph, this slot is being milled in die steel to a ⅛″ depth with a single-flute solid carbide cutter at 11,000 rpm and .005″ per pass.

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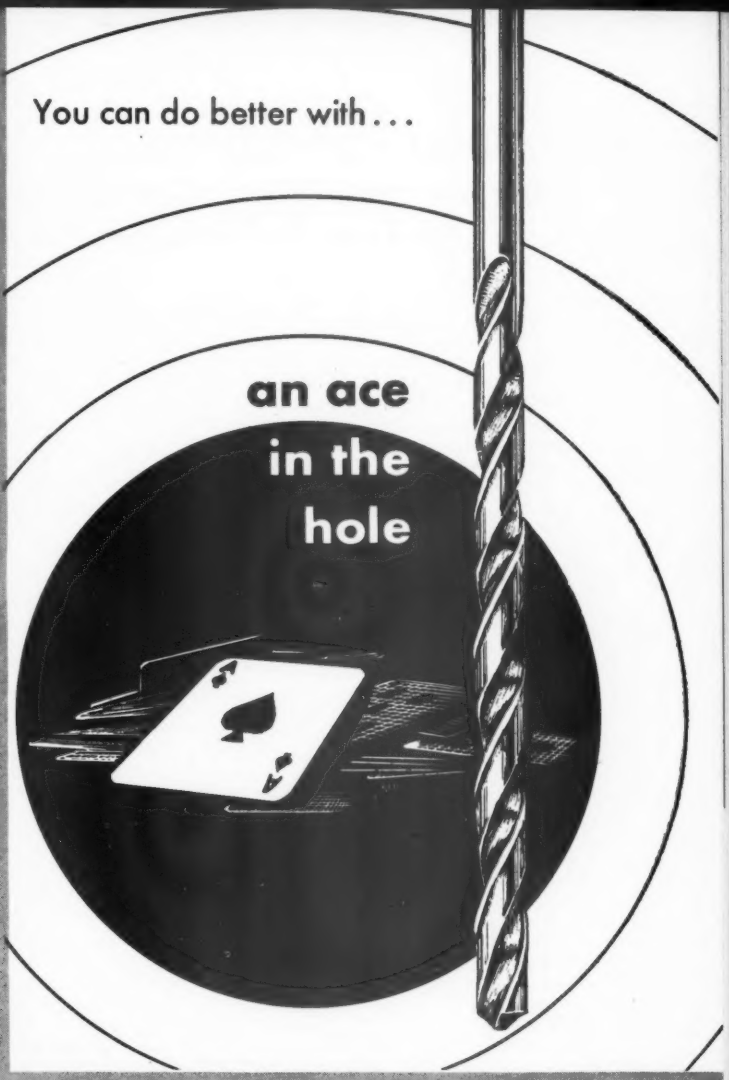

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The Metal Cutting Tool Manufacturers' Contribution to the Art of Metal Cutting

The Metal Cutting Tool Institute and its individual members have, of necessity, always been keenly interested in all new developments in the art of cutting metals. Thus, when new materials of construction appear, each of these receives careful study of its machining characteristics and its relation to tool designs and heat treatments. Likewise, when new tool materials or treatments are developed these, in turn, are studied with a view of adapting them to the best and most economical use by the metal cutting industries.

by C. J. Oxford
Chairman of the Research and Engineering Committee
Milling Cutter Division
Metal Cutting Tool Institute

It is a little appreciated fact that nearly every single object we wear or use in our modern age is, directly or indirectly, a product of metal cutting tools. Even the food we consume is processed with machinery and other equipment that would not be possible without metal cutting tools.

Another function of the Metal Cutting Tool Institute is to sponsor and promote programs of standardization and of simplification of metal cutting tools, in cooperation with industry and national standardization bodies. As long ago as the 1920's the Institute and its members took active part in the establishment of standards of metal cutting tools, resulting in the publication of these standards by the American Standards Association.

The activities of the Institute then can be divided into two categories, namely, Research and Standardization.

The development and refinement of the several types of cutting tool materials such as High Speed Steels, Cast Cutting Alloys, and Cemented Carbides has given new impetus to the Institute's research activities in the last several years. Cemented Carbides, particularly, have come in for extended study and experimentation.

In 1946 the Milling Cutter Division of the Institute named a Research and Technical Committee composed of the engineers of the various member firms to undertake studies and necessary research. This committee has been very active in studying and rationalizing the uses of the various types of metal cutting tool materials now available to industry.

"Milling with Carbides"

The results of the first project undertaken by this committee are summarized in the publication "Milling with Carbides" issued by the Institute in 1947 and widely circulated to industry at large. The seven chapters of this publication cover the following subjects:

1. General Considerations in Applying Carbides to Milling.
2. Grades of Carbides and Their Application to Milling.
3. Nomenclature for Carbide Milling Cutters.
4. Machine Tools and Fixtures for Carbide Milling.
5. Carbide Milling Cutter Design.
6. Operating Techniques for Carbide Milling.
7. Sharpening and Care of Carbide Milling Cutters.

The publication of this report was timely inasmuch as it helped to clarify, in the users' minds, which applications of carbides to milling could be expected to be both successful and economical and which could not.

Milling of Slots in Steel with Carbide Milling Cutters

The next project sponsored and financed by the Institute and supervised by the same Research and Technical Committee was an extensive research program at the University of Michigan on

the Milling of Slots in Steel with Carbide Milling Cutters.

Some important and enlightening information on this subject was developed and was reported to the Institute in 1948. This has not been embodied in a general publication up to this time.

Counterboring

Another project carried on at the same time at the University of Michigan was an investigation of the Thrust, Torque and Horsepower required for Counterboring. No information had been available previously on this important subject, as all applications had been based on general experience and empirical data. Results and data based on the above investigation are embodied in the Chapter on Counterboring in the "Metal Cutting Tool Handbook" published by the Metal Cutting Tool Institute in 1949 and now available through the Institute.

In 1948 another research project was begun. This covered a general study of Tool Materials for Milling Cutters. A report on this project has been approved for publication by the Institute and will be available in printed form in the early part of 1950. A preview of the material for this publication reveals that it will cover the following subjects:

1. The Over-all Economics of Milling Operations.
2. General Characteristics of High Speed Steels, Cast Cutting Alloys and Carbide Tool Materials.
3. Selection of a Suitable Tool Material for a Given Milling Application.
4. Problems Involved in Manufacture, Maintenance and Handling of Cutters Made of High Speed Steels, Cast Cutting Alloys and Carbide Tool Materials.
5. Speeds, Feeds and Horsepower for Milling Cutters.

Machining Stainless

The latest project authorized by the Milling Cutter Division of the Institute for study by the Research and Technical Committee is the Machining Characteristics of the Stainless Type Steels, including the High Temperature Alloys recently developed for military and other uses. No predictions can be made at this time as to the duration of this project.

Standardization and Simplification

As stated previously the Metal Cutting Tool Institute and its various members have been active for many years in developing suitable standards for Metal Cutting Tools for industry at large. This is considered a very worth-while activity in that it aids in reducing both manufacturing and inventory costs to tool users, including the Armed Services and private industry. Standardization and simplification of size ranges have resulted in uniformity of dimensions of metal cutting tools and, therefore, in ready availability from any recognized manufacturer.

The following American Standards Association Standards of Metal Cutting Tools have resulted from these activities:

B5c - 1930 Milling Cutters - Now being revised.

B5.1 - 1941 T-Slots and Cutters.

B5.4 - 1939 Taps - Cut and Ground Thread.

B5.10 - 1943 Machine Tapers.

B5.12 - 1940 Twist Drills - Now being revised.

B5.14 - 1941 Reamers - Now being revised.

B17.f - 1930 Woodruff Keyslot Cutters.

B29.a - 1930 Roller Chain Sprocket Cutters - Now being revised.

In addition the Institute and its members have cooperated in the development of numerous related American Standards such as for Screw Threads, Jig Bushings, Spindle Noses, Spur Gear Tooth forms, Involute Splines, Gear Tolerances and many others.

At the present time the Institute also has an active technical committee on Federal Specifications, whose task it is to cooperate with the Armed Services and other government establishments in establishing suitable standards on metal cutting tools for their requirements.

The Metal Cutting Tool Handbook

For many years there has been a demand for complete, authentic information and specifications on metal cutting tools. To meet this demand the Metal Cutting Tool Institute has compiled and published the Metal Cutting Tool Handbook.

This book has complete specifications on all standard types of metal cutting tools in accordance with the latest Ame-

(*Continued on page 146*)

Shaping with Carbide Tools

by John J. Murphy
Sales Engineer
The Cincinnati Shaper Company
Cincinnati, Ohio

In recent years a great deal has been written about milling, turning and planing with tungsten carbide tools. Little has been written about shaping, primarily because the shaper user has been reluctant in adopting carbides. The improvement in the shock resistance of cemented carbides during the past few years has made the use of carbides on shapers a possible and practicable application. The purpose of this article is to show the shaper user some of the possibilities in economy that come with the adoption of carbide shaping.

Material

Almost any type of material that is machinable with high speed steels can be economically machined with carbide tools. Greater economy can be obtained when shaping material such as Heppenstall "B" grade blocks, chilled cast iron, die steels, etc., where normally short tool life is encountered when using high speed steels.

Machine Requirements

A shaper to be suitable for carbide shaping must fill several important conditions. It should be capable of speeds exceeding 100 feet per minute as 100 feet per minute is considered the minimum speed at which carbides can be economically used. At lower speeds, the gains made from the use of carbides are not sufficient to warrant the added cost.

The shaper must be capable of producing uniform feeds. Excessive tool wear will result from feeds that vary between strokes.

The shaper must be equipped with a good tool lifter. Sintered carbides will not hold up if the tool is allowed to drag on the return stroke. The high speed required makes it virtually impossible for an operator to manually lift the clapper on the return stroke. Figure 1 illustrates the tool lifter supplied on the Cincinnati high speed shaper. Good adjustment of the shaper is important to eliminate chatter marks and to guarantee long tool life. Figure 2 illustrates a Cincinnati 16" high speed shaper, a machine especially adapted to carbide shaping..

Horsepower Requirements

Horsepower requirements for carbide tools are considerably higher than for high speed steel because of the high speeds and resultant higher rate of metal removal. Consequently, the shaper should be equipped with a larger horsepower motor than normally. The horsepower requirements will vary in direct proportion to the speed. Shaping at 150 feet per minute, requires one and one-half times the horsepower used at 100 feet per minute. If available horsepower is insufficient, decrease the feed instead of the speed. Horsepower required is approximately one-half horsepower per cubic inch of metal removed for cast iron and approximately twice this figure for steel.

Feeds and Speeds

The speed that can be used on any given material is dependent on many factors. Some of these are: the type of material being shaped; the tool design; the machinability of the material; character and shapes of the material; im-

Fig. 1. The Cincinnati Tool Lifter used with carbide tools to guard against breaking the tool by striking the work on the return stroke.

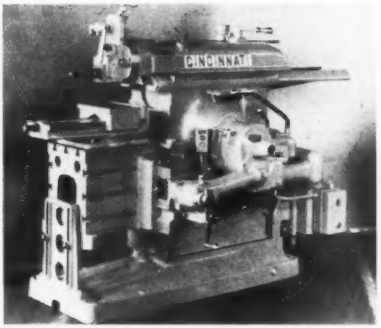

Fig. 2. 16" High Speed Shaper especially adapted to shaping with carbide tools.

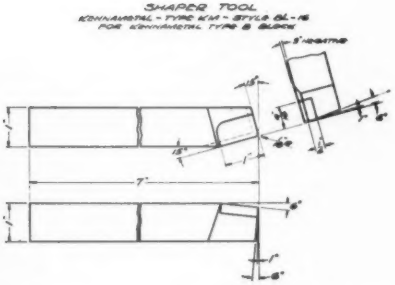

Fig. 4. General purpose carbide shaping tool for use on Heppenstall "B" Grade Block.

purities in the metal; condition of the machine; power available; and depth of cut.

The table shown in Figure 3 gives some recommended feeds and speeds for various types of material. It must be borne in mind that these are approximate figures and are dependent on the factors mentioned above. It remains for an operator or supervisor to determine the proper relationship between speed and machinability that is consistent with tool life.

Tool Design

There are many factors that enter into the correct tool design for carbide shaping. For example, a tool of a certain design may perform very well on some castings only to require changing for the next lot which may be harder or softer. The proper angles for clearance and rake are determined by the experience of the design. The slightest variation of the angles often will result in a vast improvement in the life of a carbide tool.

Figure 4 shows a general purpose carbide tool used for shaping die blocks. The carbide tool manufacturers will gladly assist in determining the proper tool design for any particular shaping problem.

Grinding and Shaping

Grinding carbide tools requires the skill of a carefully trained operator. In many shops the grinding of carbides is performed in a separate toolroom with equipment set aside for that purpose and not used for general tool grinding.

Good grinding equipment is required. The wheel must run true, and vibration must be eliminated, if a proper finish is to be obtained on the tool.

Carbides must be ground to clearance and rake angles demanded for the specific requirements of a particular job or material that is to be cut. Because of the brittle and breakable nature of cemented carbides, these angles are more critical than those of high speed steel, particularly when the carbide tip is to be subjected to impact loads as is the case in shaping. On rough grinding the carbide tool, silicon carbide wheels should be used and should be a soft bond, coarse grit, free-cutting abrasive wheel. As the carbides are very hard and dense, they cannot be ground with the ordinary grinding wheels. Grinding wheel manufacturers will help you determine the proper grade and grit of wheel for your own particular grinding problems. The rough grinding operation is usually a dry operation. Care must be exercised in grinding so as not to overheat the tool and thereby introduce internal stress in the carbide due to differences in coefficient of expansion between the carbide tip and the tool shank. Never let the tool shank get so hot that it cannot be held in the hand. Never quench the carbide tool in water during the roughing operation.

Finish grinding of the carbide tools is usually a wet operation. Use a steady stream of coolant to insure a fine finish and as a precaution against local overheating of the cutting edge. The finish grinding is performed on a diamond cutting wheel and produces a fine smooth edge free from any nicks.

A final step in grinding a carbide tool is the honing of the cutting edge

to provide a smoother finished surface and prolong the life of the cutting edge.

When a carbide tool is reground, sufficient carbide must be removed to eliminate completely the portion damaged by the previous run. Do not use a tool too long between grinds. Because of the exceptional long life of carbide tools, the user often waits too long between grinds. This is false economy as the dull tool wears rapidly, consumes power and causes poor finishes.

Selection of Carbide Grades

Selection of the proper grade of carbide tools to use for shaping is very important. Use a good shock-resistant grade of carbides. There are two general classes of carbide tool grades, the crater-resistant for use in shaping steel and the edge wear-resistant for use with cast iron. All carbide tool manufacturers supply tables for carbide grade selection. With any grade of carbide, be sure to use the correct ratio of feed to depth of cut and the direct speed.

Feeds And Speeds Chart

Material	Depth of Cut	Feed per Stroke	Speed in Feet per Minute
C. I. Hard & Meehanite	0″ to ½″	.005″-.020″	100-150
C. I. Soft	0″ to ½″	.005″-.020″	Maximum Available
Cast Steel	0″ to ¼″	.005″-.010″	150-175
1020	0″ to 7/16″	.010″-.015″	75-100
1045	0″ to ⅜″	.010″-.015″	150-175
1080	0″ to ¼″	.005″-.010″	150-200
Die Blocks	0″ to ¼″	.005″-.010″	150-200
Brass Hard	0″ to 7/16″	.010″-.015″	100-125

Fig. 3. Recommended feeds and speeds for use with carbide tools. These are approximate and depend on type, machinability, character and shapes of material, tool design and other factors.

Performance Data

A specific example of the savings that can be made in machining with carbide tools can be seen in the following comparison of high speed and carbide tool performance:

Workpiece: Die Block 12″ wide, 14″ long, 10″ high

Material: Heppenstall "B" Grade Block

Operation: Rough machine ¼″ off one side 12″ wide and 14″ long and finish

Size and type of machine: 16″ High Speed Cincinnati Shaper

High Speed Steel Tool

Cut Depth:	¼″ cut
Cut Width:	12″
Cut Length:	14″
Feed per stroke:	.030″
Strokes per minute:	roughing 15 finishing 22
Cut Speed:	roughing 36 feet per minute finishing 49 feet per minute
Time Required:	roughing 26½ minutes finishing 18½ minutes
	Total 45 minutes

Carbide Tool

Cut Depth:	¼″
Cut Width:	12″
Cut Length:	14″
Feed per stroke:	.010″
Strokes per minute:	roughing 68 finishing 99
Cut Speed:	roughing 154 feet per minute finishing 220 feet per minute
Time Required:	roughing 17½ minutes finishing 12 minutes
	Total 29½ minutes

Gain

15½ minutes or approximately 35 per cent

This is no staggering gain but is sufficient to warrant the use of carbide tools where working of die block is a regular operation. In addition to the gain in machining time, less regrinding is required as the life of carbide tools is considerably longer than that of high speed steel. Furthermore, the carbide tool will produce a better finish on the workpiece.

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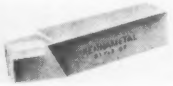
Types of Carbide Cutting Tools and Their Specific Applications

Single Point Brazed Tools

The most commonly-known type of single point carbide tool is that having an insert brazed into a recessed steel shank. Popular shank sizes and cutting edge contours are covered by industry-wide standards of dimensions, tolerances, and catalog numbering. Other tools of similar construction, either listed or made to order, are commonly used for machining materials ranging from soft plastics to hard steel. Figure 1 illustrates a typical tool of this type.

Figure 1
Typical Brazed Single Point Tool.



Brazed tools are the lowest in first cost of the types now available, and should therefore be used for jobs of short duration that do not justify the expenditure for more elaborate types. They are also frequently used in conjunction with other types of tooling, for lighter operations such as chamfering. While satisfactory for light to medium cuts, brazed tools are inclined to develop thermal cracks in the carbide when subjected to heavy duty operation.

Single Point Clamped Tools

Various types of clamping mechanisms for holding the cutting insert in proper position in a holder or shank, have been devised and used extensively. They permit economies of operation not possible with brazed tools.

Figure 2
Single Point Tool with Overhead Clamp.

The simplest of these clamped tools, Figure 2, is the one which mounts a solid insert in a recess roughly parallel to the bottom of the shank or holder which is secured in place by a clamp over a portion of the insert. This holds it down against the seat, and back against the side and back walls of the recess.

The primary use for this type of tool is in heavy cutting operations, where a brazed tool is at a disadvantage for two reasons; (1) possibility of thermal cracks, and (2) comparatively soft steel seat under the tip. With the clamped design it is possible to heat treat the steel to desired hardness, or even use a shim of tool steel which will withstand operating temperatures up to 1200°F and still provide a solid, hard seat for the insert.

This tool is somewhat easier to sharpen because only the carbide need be ground, while retaining the original form of the steel shank. Also, a worn insert may be replaced with a new one without replacing the entire tool. Initial cost is

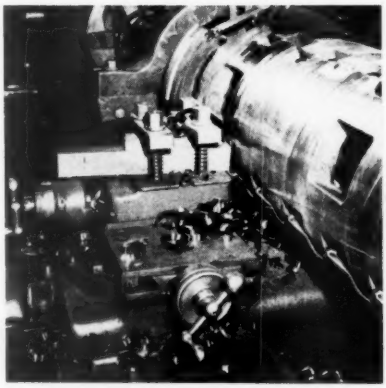


Figure 3

Workpiece:	Drum Segment Assembly, 17½" dia., 46" long.
Material:	Rough Steel Forging (sandy) 260 Brinell.
Operation:	Rough turn (severe interruptions).
Speed:	30 R.P.M., 165 S.F.M.
Feed:	.024"
Depth of Cut:	½" max. first cut, $\frac{7}{16}$" second cut.
Time:	1 hr. per pass.
Life:	2 grinds per piece (2 passes).
Tool:	Clamped K2S.

by W. L. Kennicott
Chief Engineer
Kennametal Inc.
Latrobe, Pa.

two or three times that of a brazed tool of equivalent shank size, so the performance of the tool must of course justify its use. Two examples of heavy duty tool application, with operating data, are shown in Figures 3 and 4.

The second type of clamped tool has come into wide-spread usage during the past two years. It mounts a prism of solid cemented carbide material on end, using a cross section of round, triangular or square shape which provides multiple cutting edges on each of the two ends. A square insert tool of this type can therefore be used eight times before all of the cutting edges are dulled and it rquires re-servicing in the tool room. Another advantage of the design is that little, if any, adjustment for work piece size needs to be made when the tool insert is indexed or replaced as it returns to almost the same identical setting in clamping.

The round insert holder, Figure 5, is used primarily for operations on cast iron. It has very effective cutting angles for this type of work, and permits up to 14 indexes per grind according to the depth of cut being taken. Round inserts with diameters of ⅜" and ½" are industry standard, and other rounds up to 2" diameter are in common usage on large work. The larger diameter rounds are generally made in the form of a tube with a center hole of ½" diameter or larger to reduce the regrinding area. The round is also used on some steel finishing operations, particularly contouring in a tracer type machine, as the large "nose radius" permits a smooth finish on shallow depths of cut with comparatively high feed rate.

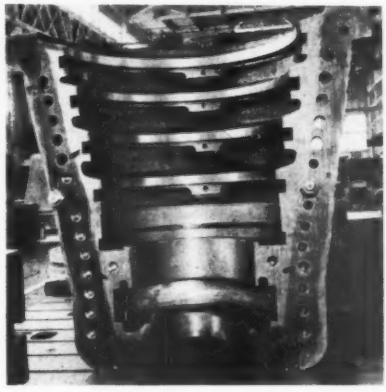


Figure 4

Workpiece:	Cast Steel High Pressure Housing for 12,500 K.W. Turbine—Two halves bolted together for machining.
Operation:	Bore and Face.
Machine:	Betts Boring Mill (180") 40 H.P.
Tools:	Clamped Type, Grade K2S.
Speed:	15 R.P.M. (top speed of machine).
Feed:	.050".
Depth of Cut:	⅜" to ½".

Figure 5
Round Insert Prismatic Type Tool.

The square insert, Figure 6, is the most commonly used shape on steel work, usually being mounted with a side cutting edge angle of about 15° which provides a similar end cutting edge angle and permits roughing cuts of moderate depth to be taken with high speed and comparatively high feed rates. Square section inserts of ⅜", ½" and ¾" are industry standard and others up to 1¼" square are in common usage for heavy work. The square insert type is the most satisfactory for general steel turning or facing, as the insert has a strong 90° included angle at the point coupled with the moderate size of nose radius desirable in the machining of steel.

Figure 6
Square Insert Prismatic Type Tool.

The triangular cross section insert Figure 7, permits turning to a square

shoulder when one of the three edges is mounted parallel to the side of the tool.

Figure 7

Triangle Insert Prismatic Type Tool.

Similarly, with the edge of the insert mounted at right angles to the axis of the tool, a design for facing to a square shoulder results, and when the insert is mounted in a turning position with a side cutting edge angle of 15°, it is possible to clear the shank on the end to permit plunge and turn operations with as much as 30° in-feed angle on the plunge portion of the cycle. The triangular insert tool has six cutting edges per grind of the insert and is available in three industry standard sizes of ¼", ⅜" and ½", the dimension representing the diameter of an inscribed circle within the triangular cross section. These give a maximum depth of cut of 11/32, ½" and 11/16" respectively when the insert is in cutting position in the tool holder.

The triangular insert is not as strong as the square type, and its use is limited to applications where plunge and turn or square shoulders make the square type insert impractical, or on thin wall tubing or small diameter shafting where the sharper point creates less tool pressure and consequently less deflection of the workpiece during the machining cycle. A modification of the square insert for deeper cuts is sometimes used, with an insert of rectangular cross section.

A wide variety of clamping devices is used on these holders for prismatic inserts, ranging from the early holders with a saw cut placed longitudinally in the shanks to permit closing around the inserts, to some rather ingenious recent clamping developments using a broached recess which accurately fits the prism of cemented carbide and a clamping mechanism entirely within the dimensions of the shank, forcing the insert against the solid walls of the broached holder in the same direction as the force of cutting. These more recent developments provide better support for the insert, more durable tool holders from the standpoint of chip erosion and more accurate indexing when the insert is rotated or replaced for a fresh cutting edge.

The prismatic type clamped cutting tools are intended primarily for high production or repetitive jobs, inasmuch as the economies of the tool depend upon longer life of a sharp cutting edge, less down time in changing cutting edges, reduced maintenance cost since the insert need only be ground once every six to fourteen runs, and the very large number of potential sharp cutting edges in a new insert. Two typical examples of the economies possible on large quantity production are shown in Figures 8 and 9. The use of large round inserts of 1¼" diameter x 2½" long on the cast iron roll turning job illustrated in Figure 8, illustrates the economies possible on large pieces where machining time per piece was reduced 60% and tool cost per piece reduced from 33c to 13c.

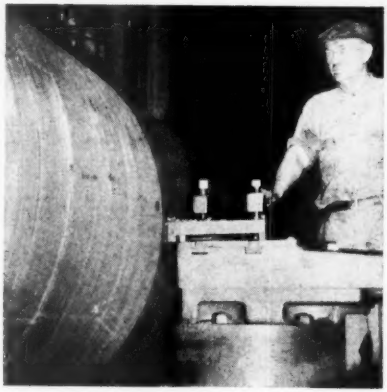


Figure 8

Workpiece:	**Drier Roll, 60" dia. x 15' long.**
Material:	**Alloy Cast Iron.**
Operation:	**Semi-Finish turn.**
Machine:	**Niles Lathe, 25 H.P.**
Tool	**Round insert 1 ¼" dia. x 2 ½" long, K6.**
Time:	**96 minutes.**
Speed:	**94 S.F.M.**
Feed:	**⅛" rev.**
Life:	**18 rolls/grind.**
Tool Cost:	**$ 13/pc.**

Figure 9 represents the most recent developments in the application of these clamp tools, where extremely high surface speeds are used to complete the turn-

(*Continued on page 103*)

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Applying Carbide Tools to Every-day Operations

Carbide cutting tools are most often thought of in connection with high production operations, where special purpose, long-term setups are involved. Yet the Warner & Swasey Company's experience covering a dozen years in the use of carbide tools on small and average lot work indicates that almost any shop may apply carbides advantageously—if a clear-cut carbide program is developed and followed.

In those 12 years, well over a million operations have been handled with carbide tooling in the production of parts for Warner & Swasey turret lathes, automatics and tapping machines, in addition to a substantial volume of subcontract work covering a wide variety of parts for a number of other manufacturers.

Such a broad experience in the use of carbide-tipped tools in relatively short-run work may be useful to others, hence a review of the history of the Warner & Swasey carbides program seems worthwhile. Such a historical approach gives the opportunity to focus particular attention on certain principles, carefully developed over the years, which were more important to our company's success with carbides than any actual details of practice.

Our company actually began to use carbides experimentally early in 1927. Immediately it was evident that this new cutting medium would be used quite commonly some day. It was quite natural, therefore, that we should attempt to install carbides in our own manufacturing processes and particularly on our own turret lathes. In the first place, the turret lathe proved one of the least difficult machines to tool with carbides, and besides, it was obviously to our advantage to know as much as possible about a material which our customers would be using in the years to come.

But although the experimental work indicated the possibilities of carbide use, it seemed impossible in those early days to secure the proper results in actual production. Operators were just not educated in the use of carbides, and the carbide sales organizations were obviously not able to spend with the operators the time required to get the proper results on each of our hundreds of jobs. Use of the new cutting medium was confined almost entirely, therefore, to experimental work and to the tooling up of machines that were used on high production work in customers' shops. If carbide installation throughout the factory was to be a success, it was evident that an entirely different procedure would have to be followed. These conclusions, made over 20 years ago, were in line with those reached by most other average lot manufacturers.

In the middle 30's, however, after a careful restudy of the entire problem, a new approach was decided upon that has proved highly satisfactory.

Our plan was to create a "carbides installation" department — this department to have complete responsibility for gathering all available information on the subject, to plan details of installation, to educate operators, to supply the proper cutters, generally supervise the entire change-over, and also, of course, to have complete control of the actual physical stock of carbides used.

To learn as much as possible from the experience of others, the program was

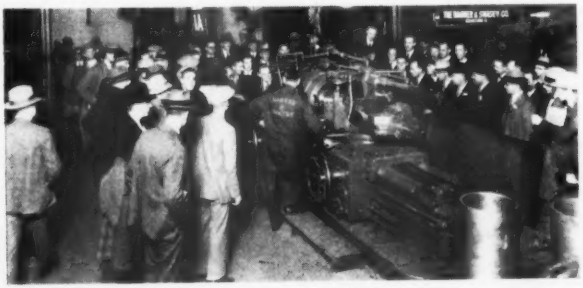

Fig. 1. Warner & Swasey's carbide experience antedated the 1929 Machine Tool Show, where carbide-equipped turret lathes turned in an attention-getting performance. Actual application of carbide tools throughout the Warner & Swasey plant, however, had to await a carefully thought-out installation program developed a few years later.

started off with a six-weeks tour of other plants. The result of this inspection trip were rather disappointing in that few of the plants doing small or average lot work were found to be using carbides very extensively. This was not too surprising when it is remembered that cemented carbide up until about 1940 cost $400.00 per pound, or $1.00 a gram! It was apparent that the trial-and-error method would have to be used, although, of course, our early experience, some help from the carbide manufacturers and the successful installations studied on the trip, pointed the way.

Upon returning to the factory at Cleveland, certain comparatively simple jobs were selected to begin the installation. It was decided that instead of tackling a large number of jobs at first, the new department should successfully complete a few less difficult assignments and only then attempt progressively harder work. Because the department had to live with the job and had to sell the new method to the operators, it was particularly careful to make no moves or recommendations that would not work out well in the long run.

The first jobs selected were of a straight "go-ahead" nature that lent themselves particularly to savings under the new method—small gears and bushings, for instance, that required only simple turning and boring operations. No attempt was made to cut steel, and only turret lathe work was tried at the very first. One of the reasons the change-over met with so much success was undoubtedly the fact that from the very beginning—and it is still the department's policy—speeds and feeds were played down rather than up. We feel that a good deal of the failure of carbides to meet with earlier success was undoubtedly over-emphasis of extremely high speeds and heavy feeds.

As the particularly obvious jobs were completed, the experience gained was valuable in carrying forward more difficult work. Because of the undivided responsibility, it was possible to know exactly why certain jobs did not work, whenever this was true.

by
James McFadyen
Cutting Tool Supervisor
Warner and Swasey Company
Cleveland, Ohio

Fig. 2. Centralized crib control keeps carbide cutters in top condition at Warner & Swasey. Here is shown a quantity of cutters returned to the Carbide Department for reconditioning. Three grinding operations use, first, 60 grit, then 80 grit silicon wheels, with the finish cut being taken on a 20 diamond wheel.

Today, about 80 per cent of all turning operations are tooled with carbides. On cast iron and non-ferrous metals, 55 per cent of *all* cutters—including turning tools, drills, reamers, milling cutters, etc. —are carbide tipped. About 30 per cent of all work on steel is handled with carbide tools, throughout the plant.

Although milling operations as a class are not ideally suited to carbide cutting, interrupted cuts as such cause very little difficulty. The machining of hexagon turret castings is handled exclusively with carbide tools, for example.

A few examples may serve to illustrate what carbides are accomplishing in the plant.

A turret lathe spindle, of 1050 steel and with a nose O.D. of approximately 20″, used to require 22 hours of machining to turn, face and neck before grinding. With carbide tools, this job is done in just six hours.

With roll support to eliminate whipping, a 3½″ O.D. by 6 ft. piston rod is finished in 54 minutes, as against a previous floor-to-floor time of 7½ hours with conventional tools.

As for the finish which can be obtained, a recent order of high-tensile cast iron

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

gas engine cylinder liners was finish-bored with a surface adjudged by the purchaser to be superior to that previously obtained by honing.

The carbide department has complete charge of all carbide tooling used throughout the Warner & Swasey plants. The department purchases the materials, makes up the necessary tools, is responsible for application and maintenance.

A centralized carbide tool crib, separate from the regular storage units, handles the sharpening, storage and distribution of all the tools. The crib is responsible for the milling of cast shanks and for the brazing of tips to the tools, Although all other tools are checked against the operator, carbide cutters are checked against the machine, since they are used far longer between grinds. Record keeping is not complicated; each shift foreman simply gives each succeeding foreman a list of the carbide tools in use in his department.

While the volume of work which passes through the Warner & Swasey carbide department makes such a practice of tool preparation efficient, the smaller shop would undoubtedly be better off to buy economical standard tools and grind any necessary changes, rather than to set up a separate shop to handle the work.

One of the most significant principles by the Warner & Swasey carbide operation was the decision to limit the types of carbides used to a minimum. Only two grades of carbides are normally used in the shop—one for cast iron and one for steel. In this way confusion and complications are eliminated, while we feel that we have learned pretty much all there is to know about using the carbide tools we have.

Perhaps one of our most surprising findings is that most cutters—exclusive of complicated form tools, etc.—can be made more cheaply with carbides than if made from regular high speed steel. The reason for this is that a carbide cutter can be brazed and ground in half an hour or less, whereas a high speed tool must be machined, heat-treated, and ground, a sequence which may take considerably more time. This fast service is also particularly useful in emergencies.

Thus at Warner & Swasey you will find carbide tools in use in some applications where high-speed steel would actually do as good a production job.

Carbide-tipped tools can also be altered to conform to design changes or for reclamation without much difficulty. We have been successful in handling a good deal of this work on a milling machine, which further expedites such changes. This was a production job that had been hardened and ground to 62-64 Rockwell. Due to change in design ⅛" had to be removed, we used carbide instead of grinding. This resulted in a saving of approximately two hours per piece.

Breakage of tools has been held at a minimum, and probably 75 per cent of the breakage which does occur is due to accidents caused by carelessness rather than any faults in the tools themselves. Actually there is no need for kid-glove handling of carbides, nor is there any point in impressing upon operators a fear psychology about this or any other aspect of carbides.

It is enough to say that carbide tools should get the same kind of treatment that high-speed tools deserve, but do not always get.

In this brief look at the use of carbides at Warner & Swasey, it will be seen that successful operations have depended upon a few basic principles, which may well serve as a guide to others who contemplate putting in these production-boosting tools.

To summarize these rules of procedure:

1. ***Study:*** Investigate the carbide situation thoroughly before plunging in. Today, carbide suppliers, other shops and machine tool builders have much valuable experience on which you may profitably draw.
2. ***Centralize Control:*** Keep the responsibility, tool handling and application problems of a carbide installation program in one place.
3. ***Start Slowly:*** Take the simplest jobs first, and tougher problems will be easier to solve without discouraging the whole organization. Don't overplay high speeds and feeds at the beginning.
4. ***Simplicity:*** Concentrate on exploiting the utmost from a few standard types of the many grades of carbide tools. Keep the operators' confidence high by playing down the idea that carbides are super-special or mysterious.

Emil Gairing, President, Gairing Tool Company, Detroit, was re-elected President of the Cutting Tool Manufacturers Association at the sixth annual membership meeting of the Association last month.

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Accurate Grinding of Carbide Dies

Since carbide die life is largely a function of workmanship and accuracy, too much stress cannot be put on the care and methods used in grinding these dies, whether form grinding or finishing holes. The jig grinder is perhaps the easiest way to obtain precise location of holes and correct alignment of all die elements, while diamond-charged forming wheels, easily and quickly made, permit accurate form grinding of complicated contours.

Diamond-Charged Forming Wheels

When form grinding carbide dies, it is customary to use diamond-impregnated wheels. These preformed wheels are not only expensive, but they must be finish formed before they can be used. The method of forming these impregnated wheels limits the accuracy of the resultant work, and probably affects the die life.

By an adaptation of the "Panto-Crush" wheel dresser, built by the Moore Special Tool Co., the die shop can now make its own accurate diamond form grinding wheels quickly and inexpensively. These wheels consist of an aluminum hub with a copper rim shrunk in place, precision turned to the correct form, and impregnated with diamond dust while under pressure contact with a mating hardened steel roll. Since the hubs can be used repeatedly, the cost of making both a roughing and a finishing wheel, probably good for 50 workpieces, amounts to only a few dollars. In addition to the savings in initial cost, these charged wheels allow more complicated contours to be formed accurately than ordinary impregnated wheels. This is due, of course, to the available forming methods in each case.

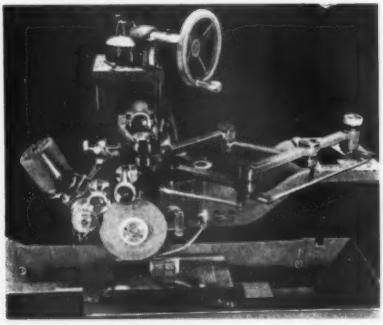

Fig. 1. The "Panto-Crush" wheel dresser provides a ready means for making accurately-profiled diamond-charged copper wheels for the precision grinding of carbide sections.

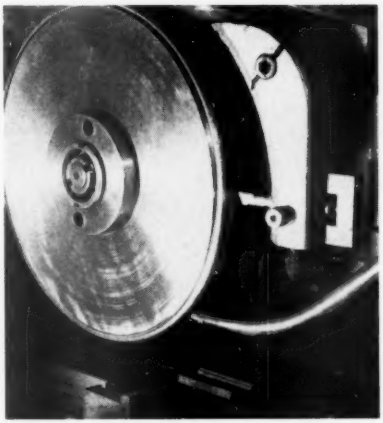

Fig. 2. The copper wheel rim is form-turned by a single-point carbide tool whose traverse is pantograph-controlled by a master template.

The technique of making these copper jacketed wheels evolved from attempts to crush-dress diamond wheels on the Panto-Crush wheel dresser. The Panto-Crush consists of a pantograph arrangement to control movement of a diamond dresser at a 10 to 1 ratio from the templet.

Under the usual procedure, the abrasive wheel is dressed to form; then used to grind a hardened steel crusher on an

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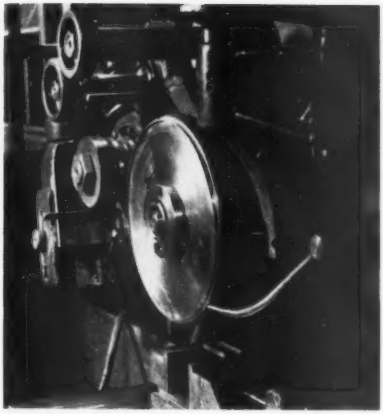

Fig. 3. The precision turned copper wheel rim is easily and uniformly impregnated with diamond dust by means of the mating form ground steel roll.

adjacent spindle. Finally, the abrasive wheel is crush dressed (when used on steel workpieces), since this process leaves sharp grains in a true periphery instead of shearing off the points as with a diamond dresser. However, when attempting to form a diamond wheel in this manner, the toughness and resilience of conventional bonds (plastic or metal) made crush dressing impractical, and a vitrified bond made maintaining radii difficult. Loss of diamond material was also excessive.

In making the charged wheels, a two-speed motor is used to drive the wheel spindle. A hardened, non-serrated crusher roll is ground as above. Then the hub, with a ¼" thick copper rim shrunk in place, is substituted for the dressed abrasive wheel, and a single point carbide tool replaces the dressing diamond. Using the proper wheel-spindle speed, the copper rim is turned to the templet form. The tool is then retracted, and the crusher roll brought into contact with the wheel at a lineal pressure of 50 lb. per lineal inch. Oil is misted on the wheel and diamond dust sprinkled on the crusher roll. For a roughing wheel, the dust should be 60 or 100 grit, and for a finishing wheel it should be 180-220. As the grit is forced into the copper face, the metal closes around the diamond grains, anchoring them securely. Since the crusher roll is a mating form, the copper is not materially deformed by the impregnation process.

The same hub can be used for both the roughing and finishing wheels. It takes from 15 to 30 minutes to slit off the roughing face, shrink on a new rim and impregnate it with the proper grit.

These wheels are operated at 6,000 sfpm., and permit 0.010" depth of cut for roughing. Wheel breakdown is a function of width and depth of form. The practical limit of width is about 1¼", because of the pressure needed to impregnate the wheel and the hp. necessary to grind carbide. It is usually best to make two or more wheels and blend the cuts to avoid inaccuracies on the width of deep forms.

These copper rimmed diamond wheels can be made for approximately 1/15 the cost of preformed wheels. Delivery time of impregnated wheels is eliminated, as well as the need of finish forming them—a difficult, time-consuming task.

Jig Grinding Holes and Contours in Carbide Dies

The form grinding method described above can be used only on certain types of die designs. Other designs call for different grinding methods. In each case, however, extreme care and accuracy are essential.

(*Continued on page 138*)

Fig. 4. The jig grinding operation insures final, accurate location and size of holes.

Tungsten Carbide Boring Tools

Tungsten carbide plays an important part in the life of Bokum internal boring tools because of its high wear-resisting qualities and also because it satisfies so extremely well the demands for the utmost in precision boring.

Tungsten carbide has contributed much toward bringing increased efficiency to boring. When this material was introduced to industry it received a very generous welcome at Bokum Tool Company because it was regarded as a fitting reward for the extensive search the company had been making for many years to find a cutting material that would possess the kind of wear resistance that a good job of boring demands.

As borne out by Bokum experience, carbide-tipped tools are practically a "must" for cutting stringy materials such as aluminum, magnesium, copper, bronze, and cast iron.

The carbide-tipped tools developed by Bokum are the same in shape and form as the original tools of super high speed steel produced by the company. The shank and body are made of oil hardened tool steel, heat treated, and in extreme cases these are made of high speed steel, heat treated, with the carbide tip inserted. The tools are then finished with diamond wheels. They are widely recognized for their combined helical and radial backed off relief which provides the simplicity of resharpening on one face only and also enhances the life of the tool.

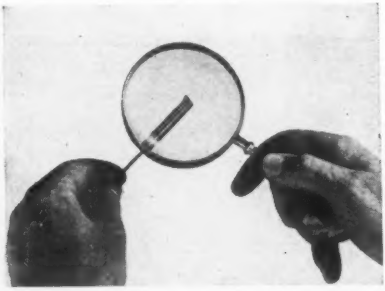

Fig. 1. New Bokum single point boring tools in solid tungsten carbide for precision boring of deep small holes.

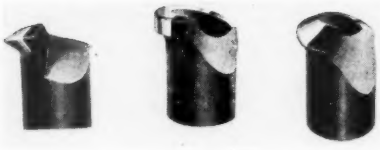

Fig. 2. Bokum carbide-tipped tools for boring, bottoming, facing, grooving and threading.

The advent of carbide has brought advantages to boring by eliminating the necessity for lapping, which would be required to bring the holes to size after heat treating. This is an expensive process. Now one can semi-finish the hole, then heat treat and finish bore, feeling confident that the bored hole is perfectly aligned.

While the use of carbide-tipped tools facilitated the general boring of small and medium holes up to 2" in depth, the problem of boring small holes exceptionally deep still remained to harass manufacturers in the instrument and hydraulic fields where the boring of deep holes with precision was a vexing responsibility.

Since tools with hardened high speed steel shanks satisfied the need to some extent, it was found that shanks of solid tungsten carbide performed much more efficiently because their modulus of elasticity is almost three times that of heat treated high speed steel. This encouraged Bokum Tool Company to develop a line of solid tungsten carbide tools for boring small holes to exceptional depths.

These tools are composed of two grades of tungsten carbide—the shank of the toughest carbide available and the head of a stronger carbide. Like the larger sizes that characterized Bokum boring tools, the heads of these small carbide tools have combined helical and radial relief that assures long life and permits resharpening on one face only.

For complete details and specifications, write Bokum Tool Company, 14775 Wildemere, Detroit 21, Michigan, or circle **Inform-A-Gram No. D6.**

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Selection of Carbide Milling Cutters

With our increased knowledge of carbides, our tool control progress and improved grinding techniques, we find that carbides are a "must" in tooling programs if we are to stay abreast of today's competitive market.

In the selection of carbide inserted blade milling cutters and similar tools, various features should be considered that will effect greatest economy. Is the construction rugged? Can standardization be facilitated through blade interchangeability? Are they easily and quickly maintained? Do they offer maximum tool life and eliminate wasteful grinding?

The most rugged of cutting tools is in solid form and therefore the inserted blade type should approach this as nearly as possible. To make your selection in this respect, consider which is stronger—slots or holes. A body tied together all around the blade offers maximum strength. It affords faster assembly; each blade can be securely locked or unlocked without affecting those adjacent. The tool should offer a blade lock that is simple and quick, yet highly effective. It should utilize as few loose parts as possible to insure against loss of time and motion. To guard against injury to the carbide, the lock should be shock-proof.

One of the most important features in the design of carbide inserted blade milling cutters is the disposition of blades within the cutter body. A cutter wears in its direction of feed. The blade should adjust as nearly as possible in a direction perpendicular to its cutting chamfer. Observe a worn milling cutter blade and note where the surface is mostly dull. It is always on the peripheral edge, whether the blade is chamfered or sharp cornered. Roughing is a metal removing operation.

by C. A. Billman

Tool Engineer
Weddell Tools, Inc.
Rochester, New York

Figure 1 shows the most efficient and economical direction of adjustment for roughing cutters. In the majority of face milling operations, most efficient metal removal will be accomplished by using approximately a 45° cutting chamfer. It is apparent that if the blade adjusts in this direction, all the carbide is used to advantage and all wasteful grinding is eliminated.

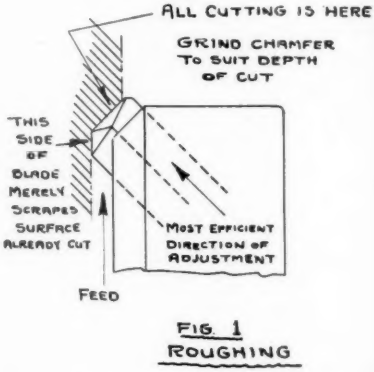
ALL CUTTING IS HERE
GRIND CHAMFER TO SUIT DEPTH OF CUT
THIS SIDE OF BLADE MERELY SCRAPES SURFACE ALREADY CUT
MOST EFFICIENT DIRECTION OF ADJUSTMENT
FEED
FIG 1
ROUGHING

Fig. 1. For milling operations which are of a roughing nature, the positioning of the teeth, the grind of the cutting edge, and the direction of adjustment, all contribute to an efficient metal removal time factor.

Figure 2 illustrates the blade disposition for finish milling. At best, finishing is a shearing operation. The blade face, ground at a slight lead angle, produces a shearing cut and also forces the spindle back into its bearings and produces a smooth surface. With the greater wear on this face, the blade should adjust mostly, but not entirely, in an axial direction.

General purpose cutters should offer adjustment in a combined radial and axial direction, or somewhere between, as shown in Figures 1 and 2. They then may be ground as roughers or finishers with chamfers to suit operating condi-

tions, to obtain maximum wear with minimum grinding.

Standardization affords lower inventories. This is of particular importance in carbide tooling which is more costly. In selecting carbide cutters, etc., the blade interchangeability should be studied. Can the same blade be used in right- or left-hand cutters? What size range uses the same blade? Can the cutter blade be used in other tools built by the manufacturer? With an eye to the future, it is also wise to select a tool in which solid and tipped blades can be interchanged.

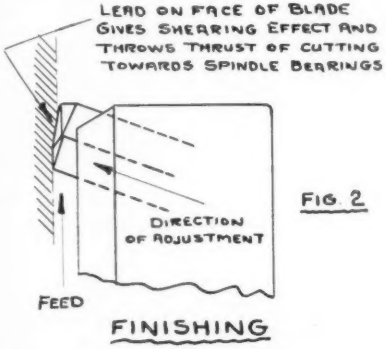
LEAD ON FACE OF BLADE GIVES SHEARING EFFECT AND THROWS THRUST OF CUTTING TOWARDS SPINDLE BEARINGS
DIRECTION OF ADJUSTMENT
FEED
FINISHING

FIG 2

Fig. 2. Compared to the "hogging" characteristics of roughing cuts, finish milling is a shearing operation. The thrust of a shearing cut forces the spindle back against its bearing which is further assurance of a high quality finish.

Today's higher labor costs must be offset by greater production. This can be accomplished with the higher cutting speeds offered through the use of carbide. Feed rates, the payoff in production, are proportional to the number of teeth engaged in the cut within a given time. Therefore, it is evident that a tool should be selected with close blade spacing, ascertaining that the blades and body are strong enough, the chips can be cleared, the machine has sufficient power, and that the part can be rigidly held.

Cutters with closely spaced blades should also be used for milling parts with narrow surfaces. Greater tool life will be achieved if more than one tooth can be engaged in the cut.

The milling of steel with carbide is done mostly with coarse bladed cutters. This has proved most practical because either adequate power is lacking or the work or setup will not permit the extreme pressure of closely spaced blades. These coarse tooth cutters give an intermittent cutting action due to the cutters bumping in and out of the work. To alleviate this effect, flywheels should be used. They should be mounted as close to the cutter as possible.

The potential energy stored in the mass of the flywheel increases the force available to go through the cut. Thus, the use of a flywheel, which smoothes out the cutting action, helps eliminate vibration and maintains a more constant cutting speed, and carbide cutter life is greatly increased. Flywheels are manufactured that mount directly on the spindle nose, providing momentum to the cutter without any wind-up or resiliency in the machine drive.

Carbide cutters should be designed to allow any amount of blade adjustment, i.e., there should be no fixed increments of adjustment. With this feature incorporated, all the carbide is usable and there is no wasteful grinding.

For most efficient use of carbide the blades should be set in slots or holes running in a conical direction, not in straight radial or axial slots. For greatest tool life, carbide cutters should be carefully ground; excessive heat will cause checking and cracking. Finish primary clearances with a 400 grit diamond wheel. Diamond hone all cutting edges. Finish ground cutters should indicate to .001" on diameter and .0005" on the face. When mounting the cutter on the machine, be sure it runs true. Remember, the finest and truest grinds produce the most work between grinds.

The newest and best ways to keep plants operating at peak efficiency will be discussed at the technical sessions of the Plant Maintenance Show and Conference to be held in the Public Auditorium, Cleveland, Ohio, January 16-19. Plant equipment, services and techniques are to be exhibited. Copies of the conference program and other details may be had by writing the Show Management, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Projected Savings with Carbides

At the close of the war in 1945, when production capacities were being utilized to the utmost to satisfy demands of a nation eager to return to its former living standards, the Electric Vacuum Cleaner Division of General Electric at Cleveland, Ohio, gave careful consideration to the possibilities of the use of tungsten carbide in metalworking dies, particularly with regard to progressive lamination dies. Accordingly, Messrs. R. W. Waterbury, Manager of Manufacturing, H. T. Lang, Development Engineer, and M. C. Parks, Tool Planning Engineer, selected their "Frame 45" armature and field lamination as a basis for calculating potential economies because of the high quality and quantity requirements. Their problem was made difficult by the fact that a five-stage progressive die for motor laminations of this design had never before been constructed of tungsten carbide, and only meager records were available to substantiate the use of tungsten carbide in other applications.

Owing to their experience with lamination dies and lamination press operations, forming tools of all types, gages and precision grinding of carbide wear parts, Cleveland Form Tool Company was offered an opportunity to consider the project and submit all procurable information that would constitute a satisfactory

by **George Banko**
General Manager
Cleveland Form Tool Company
Cleveland, Ohio

proposal. Because of experience, ability and willingness to guarantee the performance of their product, Carboloy Company, Inc., of Detroit, Michigan, was selected to furnish the necessary preformed tungsten carbide required for the undertaking.

The problems of construction in an exacting lamination die merit considerable thought, study and exchange of opinions. With the close cooperation of the Electric Vacuum Cleaner Division and the Carboloy Company, Cleveland Form Tool Company designed, built and test-ran this five-stage Carboloy progressive die for General Electric's "Frame 45" laminations.

In comparing records and costs to

This five-stage, progressive die for General Electric's vacuum cleaner motor armature and field laminations has been serviced after producing each 950,000 to 1,250,000 sets of laminations. After three years of service it has an additional life expectancy of 163,000,000 sets.

date, it has been found that only minor adjustments have been necessary while millions of laminations have been produced; truly a fine compliment to foresight, courage and cooperation. Not only is the part from this die being produced with consistent trouble-free operation in great quantities but this project has long been the favorite of press operators, assemblers and inspectors, owing to the uniformity and quality of parts; a condition impossible to realize with a number of steel dies, with their peculiarities and variations between the starts of runs and the time the maximum burr is reached. This particular carbide die has never been operated until the maximum burr has been attained and wisely so, as all the parts produced have been flowing through inspection and assembly at a consistency rate never before experienced.

Heretofore the steel dies running this same part have averaged 50,000 sets of laminations between grinds. "Frame 45 Carbide" is serviced after producing 950,000 to 1,250,000 sets of parts; the exact point dependent on convenience to production requirements but always before the maximum burr has been realized. This conservative plan of operating the die will prolong its usefulness, and has materially contributed to the fact

(*Continued on page 120*)

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SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

Carbide Cutter Know-how from "the Mill"

In the production departments of the Cincinnati Milling Machine Company extensive use is made of carbide cutters in milling the cast iron and steel components of their milling, grinding, broaching, lapping and cutter sharpening machines. Obviously, their successful use of carbide cutters is due to rigid control of all the factors that contribute to the potential economies attributable to carbide tooling. Over and above the necessary machine tool horsepower required, these factors involve the correct design and proper maintenance of carbide milling cutters. Coupled with this daily shop experience with carbides are the continuing programs of the "Mill's" Research Department.

Consequently, the newest recommendations and latest findings derived from the above shop and laboratory sources are continuously being made available to all metalworking plants through a variety of booklets, reprints of technical transactions and manuals.

"Recommendations for Grinding Carbide Milling Cutters"

This book teaches that inasmuch as consistency of tool life and successful metal removel are in proportion to the care that is exercised in sharpening the cutter, fine workmanship is a must in cutter preparation. Suggestions are given for the distribution of work in a carbide grinding department, for the storing and handling of cutters, and for the marking of cutters and the setting up of a cutter grinding record. Four pages are devoted to general equipment and general instructions: wheels; roughing wheels for circle grinding; diamond hone and dressing; cutting fluids; examination of cutter during grinding; grinding away flaws, craters and abrasion marks; inspection for run-out, clearance and body interference; and, final inspection. Following these are two detailed case histories. The first shows the step-by-step procedure for grinding a face mill after new tips have been brazed into place; and the second covers the regrinding of a face mill after becoming dulled in use. The book concludes with charts and drawings of recommended primary clearance angles based on optimum results to date of publication.

"Recommendations for Carbide Milling"

This sixteen page booklet is designed as a guide toward efficient carbide milling practice, viewed especially from the standpoint of cost analysis. It presents a revision of former publications and incorporates the latest contributions to carbide milling know-how. It gives the latest speed and cutter angle recommendations as well as an expanded section on the carbide milling of cast iron. The book is generously illustrated with setup shots, charts, graphs, and a three-dimensional drawing of the geometry of cutter tooth and chip formation. Indicative of the subjects covered are these several subtitles: recommended cutting speeds for wrought steels under average operating conditions; true rake and inclination; slab milling, slotting and sawing; milling cutter angles for cast iron; metal removal factor for cast iron; machine selection and adjustment; and, flywheels.

"look sharp at your cutters"

A baker's dozen pages of practical data in tabular and chart form extracted from the company's many publications on cutter sharpening practice and high-speed steel and carbide milling practice. Contents; axial and radial clearance angle settings; vertical setting of grinding wheel for clearance angles; recommended primary clearance angles; recommended values of cutting speed; recommended feed per tooth; elements of face milling cutter teeth; chart for determining true rake and inclination; recommended rake angles for carbide milling; effect of corner angle on feed per tooth; recommended face angles for carbide face mills; chart for determining type of tooth contact; recommended cutter grinding record of carbide cutters; and, recommended work record for carbide cutters.

The publications reviewed above are available to TOOL & DIE JOURNAL readers upon request to the Technical and Service Publications Department, Cincinnati Milling and Grinding Machines, Inc., Cincinnati 9, Ohio.

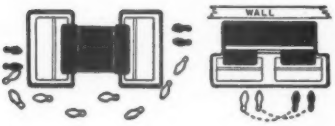
SEE FOR YOURSELF

FROM ROUGH TO FINISH GRIND IN ONE STEP!

HEAVY DUTY
WET OR DRY
10″-14″ WHEELS

TYPE
10 TD
TOOL GRINDER

PROMPT DELIVERY



OLD WAY

Lost time between rough and finish grind.

Floor space wasted—Grinder must be away from wall.

NEW WAY

One step from rough to finish grind.

Conserve floor space—place Grinder against the wall.

BULLETIN 18 IS JUST OFF THE PRESS! WRITE TODAY

THE STANDARD ELECTRICAL TOOL CO.

MT. HOPE AND SIXTH STREETS **CINCINNATI 4, OHIO**

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

Carbide Insert Holder Maintenance

Steel holders used with carbide insert tools are semi-perishable items whose service life depends to a great extent upon the care given them. For example holders are subject to wear from loosening and tightening of the clamping screws, and undue wear will be caused if chips are allowed to impinge against the holders.

The following suggestions from the Carboloy Company should help the users of carbide insert tools obtain maximum service life from the holders:

1. When machining steel, design the chip breaker to break the chip against an un-turned work shoulder, or on the side of the carbide insert, in order to protect the holder from gouging and abrasion.

2. The tool holder recess should be kept free from chips and foreign matter to avoid difficulty in properly clamping the carbide inserts. Carboloy insert recesses are broached to close tolerances so that the inserts will fit snugly, yet may be removed and indexed easily.

3. Threads of clamping and adjusting screws should be kept clean at all times to guard against stripping.

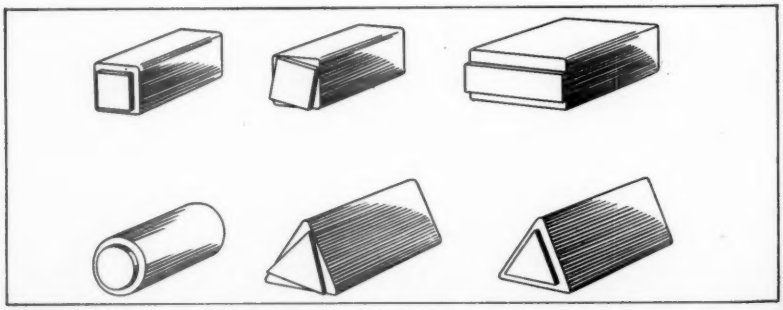
4. Do **not** use extensions on socket screw wrenches or otherwise exert more pressure on the clamping screws than is actually needed to hold the carbide inserts firmly.

Maintenance of carbide bits themselves is confined mainly to re-sharpening. When sharpening bits without chip breakers, bits may be ground off-hand on a regular Carboloy tool grinder, using a v-block or a simple holding fixture. Table of grinder should be set for "no relief," and a protractor tool guide used to maintain squareness of bit. If greater accuracy is desired, ends of inserts may be ground flat and square on a surface grinder.

When grinding chip breakers in square, rectangular, and triangular inserts, the bits are held in a simple fixture, preferably one which can be indexed so that only one setting need be made. Grinding is then performed on a Carboloy chip breaker grinder or on a surface grinder. It is also possible to leave the carbide insert in the holder and grind as if it were a brazed tool.

When "dish grinding" round inserts, the sert is ground with concave end surfaces to produce neutral or positive rakes. A thin diamond wheel is set to the insert's centerline. The periphery of the wheel forms the concavity. A 6" x ⅛" diamond wheel forms a neutral rake on a ½" round carbide insert. Smaller diameter wheels form positive rakes.

To either dish grind or grind a chip breaker ledge on a round insert, a revolving work fixture must be used. This can be accomplished by mounting a motor-driven work-head on a surface grinder, or by using a universal cutter grinder or similar equipment.



Typical chip-breaker grinds in square, rectangular, round and triangular carbide inserts. Simple fixtures can be devised to accurately duplicate the grinds.

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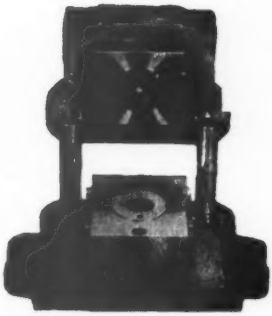
There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



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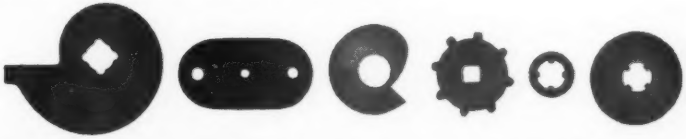

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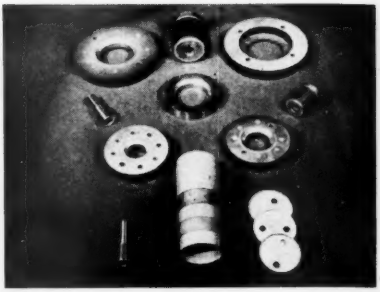
VAN DYKE, MICHIGAN
Suburb of Detroit

For instance, in the set edges or guides on our lamination presses, we use two to four small inserts of Carmet to prevent the silicon strip from wearing into the face and causing too much clearance.

The use of Carmet rings and punches in a drawing die has proved highly successful for drawing the high nickel steels such as our 4750 and Mumetal. After producing about 500 pieces on our Huron dies it was necessary to polish the draw ring, while in the Carmet ring 40,000 and more cans were drawn before polishing was necessary, and then only to remove the picked up metal.

We have Carmet blade scrap cutters on our press that have been ground or



Over 40,000 electrical alloy cans were drawn before it was necessary to polish Carmet draw rings.

Superhard Carmet inserts prevent edges of silicon strip from wearing out guides on laminations presses.

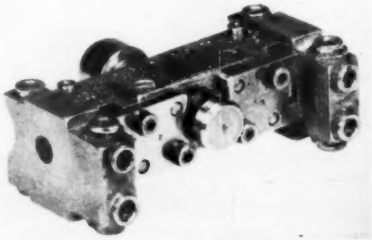
sharpened once in eleven months. We use a Carmet insert or trim ring in several 100 ton progressive steel dies, trimming an air gap of .011 from steel .025 thick or 24 gauge. Over the 7,500,000 life of one of these steel dies, this ring was sharpened only five times, removing a total of .020. You may wonder how only .020 could be removed and the die worn out. This ring is shrunk in a steel holder and each time the steel die was sharpened this assembly was inverted and the stock removed from the steel holder.

Wear Resistant Carbide Drill Jig Feet

In the plant of a large manufacturer of electrical meters and other measuring instruments, maintenance on a certain type of production drill jig was excessive due to rapid wear on the 12 hardened steel pins used as feet on the jig, the entire set of steel pins having to be replaced on an average of once every three weeks. This particular type of drill jig is used on two sides, with the back against a backing-up plate. Thus, every time a part is drilled, the jig must be turned over twice and slid on the table to clean out chips. This operation caused the rapid wear on the steel pins. Moreover, chips continually got caught under the pins causing misalignment of the drill bushing, with attendant drill breakage.

The answer to the problem was found by brazing 12 Carboloy standard .275 O.D. by .155 I.D. guide rings onto the jig in place of the steel pins—four rings on top of the jig, four on the front, and four more on the bottom, as shown in photograph.

The carbide rings have already lasted three years without showing visible signs of wear. In addition, chips do not get caught under the carbide rings because the area of contact is much smaller than on the pins. Consequently, drill breakage has been drastically reduced and time formerly wasted in cleaning chips from under the pins has been eliminated.



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. . . in the full range of sizes

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OUTLASTS ORDINARY STEEL GAGE BLOCKS by 139 to 1

- Surface finish 0.15 to 0.3 micro inch rms. Almost absolute perfection.
- Superior wringing qualities — wring best when dry and clean, assuring greatest accuracy.
- Retains original accuracy and Surface Finish.
- Will not rust or corrode.
- Guaranteed against breakage.

Write for REPLACEMENT PLAN AND FREE CATALOG 46-1

A recent analysis, made by one of the largest manufacturers of Office Machine Equipment, using a total of 260 sets of steel gage blocks, indicated that the cost of their gage blocks including a rigid inspection and replacement program amounted to $466,000 during a ten year period.

Replacement of these steel blocks with *Fonda Lifetime Carbide will result in a saving of $538,000* over a period of only twenty years.

Our representative would be pleased to assist you in analyzing your steel gage block cost and point out the savings made possible by replacing steel with *Fonda Lifetime Carbide Gage Blocks.*

also ... FONDA "ultra-finish" STEEL GAGE BLOCKS

. . . complete sets and individual sizes . . . standard inch and metric measurements . . . maximum accuracy, longer wear, finer finish and superior wringing qualities make FONDA Steel Gage Blocks superior to all others.

FONDA GAGE COMPANY

STAMFORD · CONNECTICUT

High Speed Grinder-Miller For Carbide Tool Operations

The development of burring tools from the carbon steel, hand-hewn stage to the ground-from-solid, high speed steel burr and then to the solid tungsten carbide and cemented tungsten carbide midget milling cutter has kept pace with other carbide tool developments.

Carbide midget mills require certain power characteristics in the portable grinder-miller to assure efficient operation. Among these characteristics are: (1) exceptionally high rpm; (2) high motor torque; and (3) an extremely accurate collet chuck and rigid quill to make operations at high speeds and feeds possible.

To meet these requirements Precise Products Company of Racine, Wis., developed its new Precise Super 40 Grinder-Miller which operates in a wide load speed range, starting with approximately 20,000 rpm and having a top load speed of 45,000 rpm. There is ample power supplied through the series wound universal electric motor which will develop over ¼ hp. It increases in pulling power as the load is applied to the cutting edge of the carbide tool.

Precise Products has incorporated a precision quill and collet chuck of entirely new design which simulates those usually found on heavy, stationary equipment. The high speed spindle made of chrome-nickel steel will withstand the heavy feed pressures of tungsten carbide cutting tools when used on hardened steel.

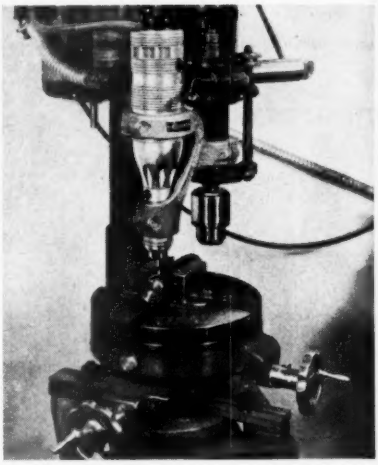


Fig. 2. Milling a keyway in steel with tungsten carbide end mill operated by a Precision Super 40.

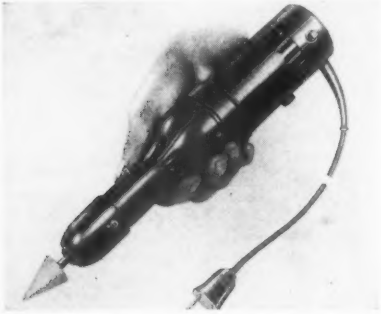


Fig. 1. The Precise Super 40 Grinder-Miller will develop a top load speed of 45,000 rpm and over ¼ H.P.

An entirely new type of micro-precision ball bearing is used to support the armature shaft and tool quill. These bearings are made to a precision measured in millionths of an inch and are of a design formerly used during the war in the famous Norden Bombsight.

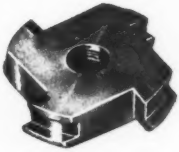
Due to a precision diamond tool bored housing, which is machined both inside and outside, it is a simple matter to mount the Precise Super 40 in various production fixtures and tool mounts, adapting it to short run and long run production jobs.

Complete data and specifications are available by writing PRECISE PRODUCTS CO., 1328-30 Clark St., Racine, Wis., or circle **Inform-A-Gram No. D10.**

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

CONTINENTAL *Carbide* CUTTING TOOLS

. . . that help you increase production at lower piece cost!



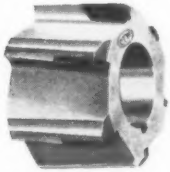
Circular form tool for form turning.

Special two-diameter cutter with inserted blades.

Cutter for forming bevel on cylinder head valve seat inserts.

Taper shank pilot reamer.

Roughing and finishing doming cutters for aircraft cylinder heads.



Shell reamer.

Tool for forming convex radius.

One quick way to new low piece cost in fast-approaching competitive days may be a retooling program that puts greater emphasis on the use of carbide cutting tools. Continental Tool Works engineers, pioneers in the application of carbide, have a unique background of experience in designing and manufacturing carbide-tipped cutting tools . . . a practical experience that is at your disposal.

Get in touch with Continental today!

CTW

CONTINENTAL TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

Carbide-tipped Circular Saws

Carbide-tipped circular saw blades are meeting with widespread success in the sawing of both non-ferrous and non-metallic materials. Such blades have found a definite place in the production cutting of materials, producing smooth, straight, burr-free cuts with the additional feature of increased wear life. Substantial savings in cost result from increased production and reduced downtime. Reports received from field installations of Motch & Merryweather carbide-tipped saw blades, Figure 1, indicate that on certain jobs an increase of 10 to 20 times the life of an ordinary high speed steel saw blade may be expected from the use of carbide. One application in which a variety of copper and brass shapes were cut on a production basis revealed that a "TripleChip"* carbide-tipped saw blade lasted 80 hours as compared with an 8-hour run of a high speed steel saw.

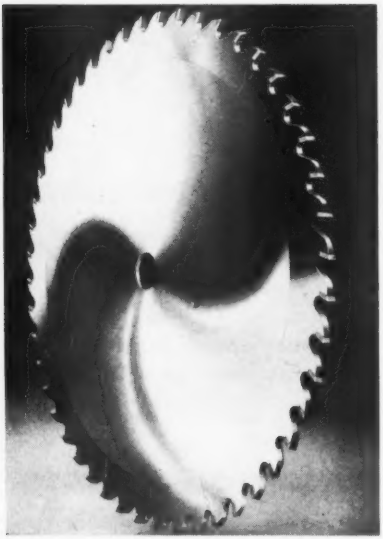


Fig. 1. Field experience on certain jobs indicates Motch & Merryweather "Triple-Chip" carbide-tipped saw blades will give an increase of 10 to 20 times the life of the ordinary high speed steel saw blade.

*Reg. U. S. Patent Office

Fig. 2. "Triple-Chip" type of tooth form breaks up the full width of the cut into three separate chips.

A new user of carbide-tipped saws is sometimes halted by their initial cost as contrasted with that of the high speed steel or semi-high-speed steel saws he may have been using. The purchase price of a carbide-tipped saw blade may be 5 to 6 times that of a high speed steel saw, and yet in the final analysis the cost per cut using carbide will be one-third. Case example:

A leading electrical manufacturer cutting off manganese-bronze shapes. On production runs the carbide-tipped saw blade cut off 18 times as many pieces as the original high speed steel saw. Though the initial cost of the carbide-tipped "Triple-Chip" saw was $275.00 as against $60.00 for the high speed steel and the resharpening cost was six times that of resharpening a high speed steel saw, the final figures prove the cost per cut to be one-third that of the high speed steel saw blade.

Carbide-tipped saw blades are now available with tips brazed to solid and segmental bodies. Solid carbide saws are restricted to small diameters, generally under 3", while tipped types can be supplied up to 45" diameter. In general, positive rake angles and ample clearance angles are used for sawing non-ferrous and non-metallic materials. Carbide-tipped saw blades are usually manufactured for a particular application, because the right grade of carbide must be incorporated in the saw blade if maximum performance is expected.

The tooth grind varies with the class of material to be cut. Non-ferrous metals are best cut with a "Triple-Chip" type of tooth form, Figure 2, which breaks up the full width of the cut into three separate chips. Non-metallic materials, such as phenolic and acrylic based plastics, resinous materials, plywoods and hardwoods, are cut most advantageously with saws having alternately beveled teeth.

Circle Inform-A-Gram No. 8

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SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

. . . *Freedom from Brazing Stress*

packing necessary for shoulder work on semi-automatic machines.

Brazing stresses may be minimized in many different ways. For example, the strength or tightness of a braze is, for a given grade of carbide, type of shank steel and kind of brazing material, almost a direct function of the thickness of the brazing film between the tip and shank. There exists, in fact, a critical film thickness which corresponds to the highest braze or joint strength. This would seem to be desirable, except in the case of the harder grades of carbide or adverse tool design. The optimum braze thickness naturally exerts a maximum tensile stress upon the carbide on cooling from the brazing temperature. The relation of braze film thickness to joint strength is displayed in Figure 9.

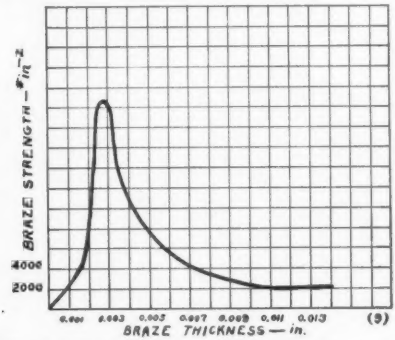


Fig. 9. Braze thickness vs. braze strength.

There are several ways in which the braze thickness may be controlled in order to limit the amount of brazing stress to which the tip is subjected. The thickness of the joint may be safely increased without materially reducing the holding power of the braze by the use of wire gauze, placed between the tip and shank. A suitable material for this purpose is No. 22 mild steel wire gauze, tinned before weaving. The thickness of the braze film can be easily controlled when the tip is mounted in a slot or, in other words, when it is confined by the steel shank on two parallel sides. The thickness of the braze film can be controlled in such a case by grinding the tip on parallel sides to the proper thickness, leaving the desired amount of clearance on each side for the brazing film.

(*To be continued*)

. . . *Carbides Today*

procurement policies by one of our largest corporations. This company, which for years has made a high proportion of its own carbide tools, has almost abandoned its own carbide tool fabrication in order to put itself in position to take advantage of the know-how of the carbide tool manufacturing specialists.

Performance vs. Application

This does not necessarily mean that the company believes the tool manufacturers can make the same tool much better. Rather it indicates a realization that the performance of a carbide tool depends tremendously on the manner of its application. When your suppliers get two and three times the tool life machining the same part you are machining—using the same tool material, on the same tool material, on the same types of machines —that is something worth looking into. The difference? Perhaps a slightly different tool shape, or a different combination of feeds and speeds and depths of cut.

Better Carbides Today

This does not mean that there have not been valuable improvements in carbide metals. There have been, but there has been nothing to match, say, the development of the first real steel cutting grades back in 1937-1938. Yet the better metals have helped, when combined with an immense expansion of knowledge as to the application and maintenance of carbide tools, to give us standards of expected average performance today which are far ahead of what we thought was exceptional a few years ago.

Future Progress

Where do carbide tools go from here? That question can be answered neither by the carbide manufacturer, the tool producer, the machine manufacturer nor the tool user. Future progress depends on all four, working together. That they are working together is the best indication that we can look for even wider utilization, and even more effective applications, of carbides in the future.

ing and facing operations on a stem pinion gear in a machining time of 8½ seconds per piece. This is of course an extremely high production automotive part, but serves to illustrate the speed of machining possible when conditions are ideal. In this case, a special purpose machine was developed and built specifically for this job with provisions for rigidity and short duration high power output never before thought necessary for such a workpiece.

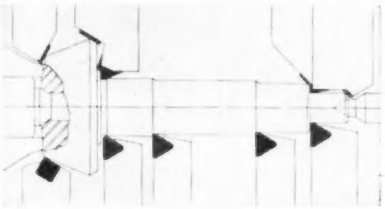


Fig. 9. Use of Prismatic Type Tools on Stem Pinion Gear Blank.

Carbide Insert Drill Bushings

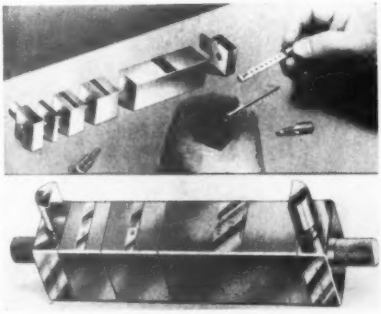
Because the points of maximum wear are at the ends rather than the middle of the bushing I.D., carbide insert drill bushing shows 85% to 95% of the life of a solid carbide bushing. Due to the expansion coefficient difference between steel and carbide, the ring type insert bushing permits the steel bushing body to conform to work temperature changes without cracking the carbide. Further, when heat is generated within a bushing it generally is greatest at the middle portion of the bushing body. With the middle portion being of steel, it expands in correspondence to the drill's expansion, thus relieving that area where freezing of the drill would most likely occur. Production case histories show that "Meyco" bushings, manufactured by the W. F. Meyers Company, Bedford, Indiana, are effecting dollar savings, increased life, and work accuracy, decreased down-time for replacement and lessened drill breakage. In addition to serving to guide drills and reamers, Meyco bushings are being employed as tubular wear parts.

Circle Inform-A-Gram No. D12.

Pratt & Whitney, Hoke Carbide Gage Blocks

The gage block set shown above is made up of solid carbide blocks in the sizes under 1", the 1" and larger being carbide-tipped. Due to the extremely long wear life of the carbide surfaces, the initial accuracy of the blocks is extended many times. The measuring surfaces of each block are precision lapped at 68° F to tolerances for size (per inch), flatness and parallelism tolerances ranging from two to four millionths. The set includes fittings and accessories for building up special gages, such as the inside caliper, below, that are of gage block accuracy. Illustrated literature shows how outside calipers, layout scribers, center points and height gages may also be built up by means of standard steel attachments, tie rods and fastenings. These present a "short notice" means of performing precision gaging and inspection jobs.

Circle Inform-A-Gram No. D11.



SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

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The Dahlstrom Tap Guide practically eliminates tap breakage and saves wasted hours getting broken taps out of expensive dies. It does the job in a jiffy with work always straight and true. Carry it over to your big work, or fasten it to a post, slip a Tap Adaptor into the spindle, and even an inexperienced operator can handle it. Equipped with 9 Adaptors, ranging from 8-32 to ¾".

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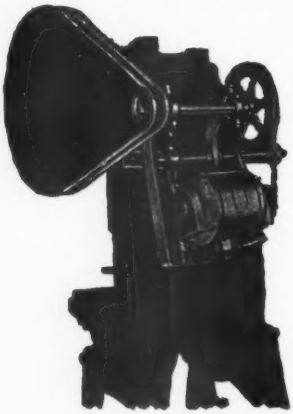

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held insert are obvious since an insert need only be indexed when dulled, not reground or replaced. In the case of triangular types, six cutting radii are readily available before regrinding is necessary. Cutting edges on the round type are determined, of course, by the depth of cut. The square type insert may be used on all turning operations and affords eight cutting surfaces; however, there is one exception, where a cut is made to a shoulder. On this application triangular inserts are more applicable. The rectangular types are adaptable to operations where a long cutting edge is required in a narrow width of tool.

The vertical holder is designed primarily for production setups where several tools are incorporated, as this design allows the insert to be rotated to a new cutting edge without resetting the tools. This saves the setup time that would be necessary if brazed tipped tools were used. In many cases where complicated tool setups are involved (Figure 2) this may amount to several hours saved per run.

The horizontal holding method uses a square solid carbide insert 2½" long, that is securely held in the body of the shank. Clearances and radius are ground on this insert to fit the job. There is a filler plug behind this insert backed up by a screw that provides an efficient method of advancing the carbide before being reground or removed. This type tool has the flexibility of a brazed tool plus the strength and stress-free performance of solid carbide. It was primarily designed for operations such as boring, and other space-limited applications. It is not as economical to use for mass production as the vertical type holder because the insert cannot be rotated. It is more suitable for short run jobs. The insert can be ground in the holder to suit most applications.

There are several fixtures on the market for use in grinding chip breakers on the solid carbide inserts. Figure 3 shows one of the most efficient designs. With this fixture any type insert can be ground with suitable chip breakers to machine aluminums, cast iron, steel, etc., where needed.

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G ELECTROLON GRINDING WHEELS, developed for sharpening carbide tools efficiently and economically, are described in an attractive new bulletin published by Simonds Abrasive Co. These silicon carbide, vitrified bonded wheels are particularly efficient for roughing. The bulletin contains grain and grade recommendations, a table of specifications for 30 popular carbide tool grinders, and tips for grinding carbide tools. Address SIMONDS ABRASIVE CO., 5516 Tacony St., Philadelphia 37, Pa.

Circle Inform-A-Gram No. B1.

SOLID CARBIDE BLADE MILLING CUTTERS are pictured and described in the extensive Beaver Catalog No. 49. Tabulations of standard cutters and blades, sharpening procedures, and recommendations for optimum results are included. Other products, including tool holders, arbors, adaptors, and special tools, are also described in this catalog. Write

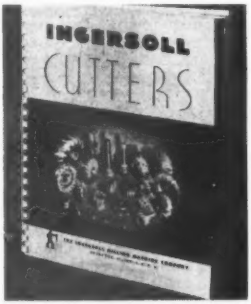
to BEAVER TOOL AND ENGINEERING CORP., Dept. S, 2850 Rochester Rd., Rt. 1, Royal Oak, Mich.

Circle Inform-A-Gram No. B2.

TWO NEW PRECISION GRINDERS, for single-point carbide tool sharpening, are announced in an eight-page bulletin just issued by Oliver Instrument Co. They are the 10" Template Tool Bit Grinder and the 20" Template Tool Bit Grinder. These machines utilize a controlled and numbered template so that the complete tool can be sharpened on the one grinder instead of on several grinders. OLIVER INSTRUMENT CO., 1436 E. Maumee St., Adrian, Mich.

Circle Inform-A-Gram No. B3.

INGERSOLL CUTTERS are featured in the company's latest catalog, No. 56H. All cutters shown in this comprehensive, 76-page book can be furnished with carbide-tipped blades. Copies of this catalog may be had from INGERSOLL MILLING MACHINE CO.,



Dept. 56H, Douglas & Willoughby, Rockford, Ill.

Circle Inform-A-Gram No. B4.

CARBIDE SPECIAL TOOL APPLICATIONS, for reaming, facing, chamfering, drilling, boring, turning, forming, counterboring and milling, are illustrated in Ex-Cell-O's interesting

Bulletin No. 11132-X. For a copy write CONTINENTAL TOOL WORKS, DIV. OF EX-CELL-O CORP., 1200 Oakman Blvd., Detroit, Mich.

Circle Inform-A-Gram No. B5.

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PUBLICATION PREVIEWS

MAGNETIC CHUCKS and other permanent magnet type magnetic holding tools are featured in an informative booklet from Brown & Sharpe Manufacturing Company. B & S magnetic chucks, permanent magnet type, do not require electric current. The magnets of a special alloy are many times stronger than magnets previously available and last indefinitely. Work can be held on the chucks as long as desired without damage to work or chuck. For a copy of this illustrated booklet address BROWN & SHARPE MFG. CO., 235 Promenade St., Providence 1, R. I.

Circle Inform-A-Gram No. B6.

INDUSTRIAL AIR EQUIPMENT is the subject of a comprehensive catalog issued by Air-Mite. Air-Mite cylinders were designed with emphasis on simplicity but incorporating the qualities of high strength, non-rusting cylinder heads and "true bore" cylinders. Other devices described in this 16-page catalog are air arbor presses, quick exhaust valves, speed control valves, air vises, blow guns, etc. For Catalog No. 49, write AIR-MITE, 2651 W. Lake St., Chicago 12, Ill.

Circle Inform-A-Gram No. B7.

A NEW RECIPROCATING WORKPIECE HOLDER with universal head, for polishing, buffing, gear burring and brush finishing, is the subject of a four-page bulletin available from The Osborn Manufacturing Company. This holder is designed to increase production by substantially reducing manual labor in the finishing of many small metal parts. Free copies of this illustrated bulletin may be secured by addressing requests to THE OSBORN MFG. CO., Dept. 47, 5401 Hamilton Ave., Cleveland 14, Ohio.

Circle Inform-A-Gram No. B8.

THE ROBRA FORM DRESSER, for the shaping of grinding wheels, is illustrated in new literature from The DoAll Company. This tool is designed to dress a radius "out of tangent" as well as a "radius tangent to an angle". The wheel is dressed on the bottom without removing the guards, which insures utmost safety to the operator and keeps working parts remote from abrasive dust. Address THE DoALL CO., 254 N. Laurel Ave., Des Plaines, Ill.

Circle Inform-A-Gram No. B9.

NEW TYPE "M" UNIT DUST COLLECTORS are featured in recent literature from The Kirk and Blum Manufacturing Company. With one of these units, the dust laden air is delivered to a small diameter, high efficiency, centrifugal pre-cleaner where all but the finest particles are removed. The air then passes through steel wool filter pads, 3" thick, for final cleaning. Address requests to THE KIRK AND BLUM MFG. CO., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

Circle Inform-A-Gram No. B10.

THREAD MILLING CUTTERS, for Pratt & Whitney thread milling machines, are presented in Circular No. 522. These cutters are made of fine quality high speed steel and correctly hardened. Special surface hardening treatment given these cutters results in extremely long wear life. They are furnished for cutting the following thread forms: National, V, Acme or Worm Threads. Specifications, sizes and prices are listed. PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.

Circle Inform-A-Gram No. B11.

THREE NEW OPTICAL INSPECTION INSTRUMENTS are described in illustrated data sheets issued by Buhl Optical Company. The instruments are the S-129 pocket microscope (40 to 60 power), the S-152 Handi-scope (20 power) and the S-42 Magniprox desk magnifier. Specifications, prices and operating information are included in the description of each instrument. Copies may be obtained by writing the manufacturer, BUHL OPTICAL CO., in care of Dept. T-111, 1009 Beech Ave., Pittsburgh 12, Pa.

Circle Inform-A-Gram No. B12.

AIR-HYDRAULIC PRESSES, for forming, flanging, marking, assembly, riveting, broaching, crimping, staking and press fitting, are offered in a bulletin available from Air-Hydraulics, Inc. These presses deliver delicate pressures for the lightest jobs, or up to 2½ and 6 tons pressure (based on 100 lbs. air inlet pressure) for work now being done on presses many times the size. Complete specifications and a table of models in the 2½ and 6 ton sizes are included. AIR-HYDRAULICS, INC., Dept. A, 120 W. Middle St., Chelsea, Mich.

Circle Inform-A-Gram No. B13.

ROLL FORMING MACHINES. A new bulletin from American Roller Die Corporation details the latest improvements in ARDCOR roll forming machines which form, curve, emboss and cut—all in one continuous operation. Besides a complete listing of new features, this bulletin also gives capacities and specifications of ARDCOR Type "F" roll forming machines. Write for your copy to AMERICAN ROLLER DIE CORP., 20550 St. Clair Ave., Cleveland 17, Ohio.

Circle Inform-A-Gram No. B14.

THE S-27 DIE SPRING ASSORTMENT has recently been announced by Paragon Spring Company to meet the requirements in general shop applications and experimental departments. The assortment includes 27 surface-stressed die springs 11" long over-all, with plain ends, to fit holes from 7/16" to 1 9/16" and fit rods from ¼" to 15/16". A bulletin describing this complete assortment is available from PARAGON SPRING CO., 4613 W. Fulton St., Chicago 44, Ill.

Circle Inform-A-Gram No. B15.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

CARBIDE MILLING CUTTERS are featured in the comprehensive Catalog 13 published by The OK Tool Co., Inc. An interesting discussion of the various aspects of carbide milling is included in this 59-page, illustrated booklet. Specifications, sizes and photographs of many carbide cutters are contained in this publication, along with descriptions of cutters made from other metals. THE OK TOOL CO., INC., Dept. TDJ, Shelton, Conn.

Circle Inform-A-Gram No. B16.

MEYCO CARBIDE-INSERTED DRILL JIG BUSHINGS are presented in a booklet of specifications that comes with an up-to-the-minute price list. MEYCO bushings combine the best features of carbide and steel. W. F. MEYERS CO., INC., Meyers Bldg., 1017 14th St., Bedford, Ind.

Circle Inform-A-Gram No. B17.

FONDA'S LIFETIME-CARBIDE GAGE BLOCKS offer toughness, wear resistance, accuracy and good wringability. An illustrated catalog details these features and lists latest prices. Address FONDA GAGE CO., 59 Daly St., Stamford, Conn.

Inform-A-Gram No. B18.

CARMET DIE SECTIONS, blanking dies, drawing dies and other specialties for die makers are described and pictured in a booklet that may be secured from the manufacturer, ALLEGHENY LUDLUM STEEL CORP., Dept. TD-83, Pittsburgh, Pa.

Inform-A-Gram No. B19.

THE HAGER UNIVERSAL CARBIDE GRINDER, featuring patented, built-in "Reciprocating Action", is the subject of a recently-revised, eight-page catalog. Typical setups are shown. E. F. HAGER AND SON, Dept. TDJ, Queens Village 9, N. Y.

Inform-A-Gram No. B20.

REVERSIBLE CARBIDE PLUG GAGES and other types of gages are offered in a three-color catalog, No. 49, obtainable from SIZE CONTROL CO., 2500 W. Washington Blvd., Chicago 12, Ill.

Inform-A-Gram No. B21.

ADAMAS CARBIDE BLANKS are the subject of a newly revised price list and catalog. This publication features the new standard styles, sizes and tolerances for blanks recently adopted by the principal carbide manufacturers; a simple method of computing prices on non-standard blanks; and standard and special grade designations. ADAMAS CARBIDE CORP., Box 149, Harrison, N. J.

Circle Inform-A-Gram No. B22.

JARVIS CARBIDE ROTARY FILES are presented, along with high speed files, in literature from the company. Actual-size photographs of all standard sizes and shapes are included. Also described are ground-from-the-solid carbide midget rotary files. Write THE C. L. JARVIS CO., Dept. TDJ, Middletown, Conn.

Circle Inform-A-Gram No. B23.

SUPER-HARD
SUPER TOOL CO.
Drill hardened steel at less cost
Super's new prices mean greater economy in drilling hardened die sections. Available in standard kits of 5, or in selected sizes at unusual savings . . . . . Write for folder.
Now
3/16" at $3.50
15 Sizes up to
3/4" at $6.50
SUPER TOOL COMPANY
21650 HOOVER RD. DETROIT 13, MICH. • 5210 SAN FERNANDO RD. GLENDALE 3, CAL.

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PUBLICATION PREVIEWS

CARBIDE PLUG GAGES are among the many types of cylindrical gages pictured and described as to size and price in a recent publication of The Farmington Engineering Company. Standard sizes of both "go" and "not go" cylindrical plug gages are listed. In addition to making large steel ring gages up to 17" ID, the company makes carbide and Norbide ring gages. Address THE FARMINGTON ENGINEERING CO., Gage Dept., 595 New Park Ave., W. Hartford 10, Conn.
Circle Inform-A-Gram No.. B24.

CARBOLOY DIE CATALOG SUPPLEMENT. Supplement D-3 (to General Die Catalog D-126), carrying details of improved features in Carboloy standard round hole dies, has been issued. Write for it to CARBOLOY CO., INC., 11111 E. 8-Mile Rd., Detroit 32, Mich.
Circle Inform-A-Gram No. B25.

THE GRINDING OF CEMENTED CARBIDE TOOLS can be effectively accomplished on Bay State Diamond Abrasive Wheels. An excellently illustrated, 34-page catalog contains valuable wheel data and is of interest to anyone grinding cemented carbide tools. For catalog write BAY STATE ABRASIVE PRODUCTS CO., Dept. B-2, 1 Union St., Westboro, Mass.
Circle Inform-A-Gram No. B26.

TUNGSTEN CARBIDE DRAWING DIES CATALOG. A 36-page catalog, No. 48-WP, contains full prices and particulars on Talide-tipped centerless grinder blades, sheet metal draw dies, tubes and wear strips, and other carbide products. Write METAL CARBIDES CORP., 101 E. Indianola Ave., Youngstown 5, Ohio.
Circle Inform-A-Gram No. B27.

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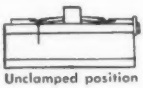
THIS IS IT

FOR HOLDING YOUR NON-MAGNETIC MATERIALS

Permits brass, copper, plastics, glass, hard rubber, aluminum — in fact any rigid material — to be held on a magnetic chuck for machining. Magna-Vise greatly increases the versatility and usefulness of your magnetic chucks. You'll want *all* the facts... write today, Dept. TJ-10.



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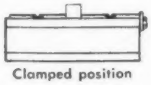

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Get the story, too, on Magna-Lock Chucks... *first* to increase your machine's productivity.

* Patented

HANCHETT Magna-Lock CORPORATION

Magnetic Chucks and Devices

BIG RAPIDS, MICHIGAN

CARBIDE MIDGET MILLS are among the many types of carbide tools illustrated and described in Severance's Catalog No. 17. This 32-page book gives dimensional data, cutting speed recommendations and a description of regrinding services. Write SEVERANCE TOOL INDUSTRIES, INC., 730 Iowa St., Saginaw, Mich.
Inform-A-Gram No. B28.

BARTH CARBIDE DIES. One of these dies, cutting two pieces at a time out of .005" nickel for radio tube parts, has made six million hits and looks good for 25 million hits before it will require sharpening. Literature on these wear-resisting dies is available from BARTH STAMPING & MACHINE WORKS, 3184 W. 34th St., Cleveland 9, Ohio.
Inform-A-Gram No. B29.

RAYMAC SOLID CARBIDE GRINDING TOOLS. carbide rotary files, solid carbide midget burs, carbide drop forge burs, solid carbide end mills and solid carbide centerlaps are pictured and described in an attractive catalog available from RAYMAC MFG. CO., INC., Dept. TDJ, 3729 Cass Ave., Detroit 1, Mich.
Inform-A-Gram No. B30.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

WET AND DRY CARBIDE TOOL GRINDERS are described and pictured in Hammond's Catalog No. 220. Features, specifications and illustrations of dry, wet and combination wet-and-dry carbide tool grinders are given. Chip breaker and diamond finishing grinders are also included. HAMMOND MACHINERY BUILDERS, INC., 1631 Douglas Ave., Kalamazoo 54, Mich.

Circle Inform-A-Gram No. B31.

WESSONMETAL CARBIDE BLANKS and Wesson Carbide Cutting Tools are the subjects of a colorful new publication, Bulletin 491. Standard and special grades of Wessonmetal are listed. Many types of tools are described as to price and dimensions. WESSON CO., Woodward Heights at Ruckel, Ferndale 20, Mich.

Circle Inform-A-Gram No. B32.

CARBIDE MILLING can be performed with coarse tooth cutters, and with smoother cutting action, by the use of Weddell Flywheel Arbors or Adaptors. These flywheels, when incorporated into the drive, give momentum, which eliminates vibration. They also increase carbide cutter life. Write for descriptive bulletin to WEDDELL TOOLS, INC., 31 Centennial St., Rochester 7, N. Y.

Inform-A-Gram No. B33.

CARBIDE-TIPPED REAMERS are pictured and described in Pratt & Whitney's Circular No. 508. Sizes and prices are given for fluted chucking reamers, adjustable chucking reamers and adjustable shell reamers. Address PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.

Inform-A-Gram No. B34.

DoALL TUNGSTEN CARBIDE LINE MILLING BANDS make possible both straight and contour machining of tough and abrasive materials. These new cutting tools withstand high frictional temperatures encountered at the tooth tip. Write for descriptive Form No. 49-808. THE DoALL CO., Dept. TDJ, Des Plaines, Ill.

Inform-A-Gram No. B35.

CARBIDE DIES AND WEAR PARTS, carbide-tipped standard tools and many other carbide products made by Corundum are described and pictured in the company's most recent literature. Address CORUNDUM CO., INC., 1775 E. 87th St., Cleveland 6, Ohio.

Circle Inform-A-Gram No. B36.

HASKINS CARBIDE FILES are ground from solid tungsten carbide blanks. Standard shapes and miniature burs are illustrated in a new bulletin available from R. G. HASKINS CO., 605 S. Washtenaw, Chicago 12, Ill.

Circle Inform-A-Gram No. B37.

CARBIDE-TIPPED LATHE TURNING TOOLS are offered in illustrated literature published by Johns Mfg. Co. These tools work free hand equally well in plastics, metals or wood. Address JOHNS MFG. CO., Dept. R, Dunellen, N. J.

Circle Inform-A-Gram No. B38.

ACCURACY TO .0001"
IN PRODUCTION SET-UPS

FOR AS LITTLE AS
$117.50

Internal grinding on lathe with PRECISE wheel arbor mounting 1½ D. wheel.

LOWEST COST PRECISION. When mounted on standard machine tools, PRECISE SUPER 40 at speeds from 20,000 to 45,000 R.P.M. turns out precision jobs heretofore possible only on stationary machines costing up to 100 times as much.

VERSATILITY. For cylindrical, internal, external and form grinding; for milling with H.S. steel or tungsten carbide midget mills; for micro-finishing and polishing. Use on wood, glass, rubber, plastics, or any metal including the hardest alloy steel.

DURABILITY. All metal housing, rigid PRECISE quill, lubricant-sealed micro-precision bearings. ¼ H.P. AC-DC motor (115 volts) is protected by replaceable fusetrons.

ATTACHABLE COOLFLEX SHAFT. (optional) Quickly attached for bench work and handtool applications. Same speeds, same precision quill as in PRECISE SUPER 40.

Milling hardened die with tungsten carbide mill in COOLFLEX ATTACHMENT.

Write FOR CIRCULAR

PRECISE PRODUCTS CO., 1341 Clark St., Racine, Wis.

PRECISE SUPER 40

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PUBLICATION PREVIEWS

UNIVERSAL STANDARD DRILL BUSHINGS are the subject of newly released Catalog No. B-1018. All necessary specifications, tolerances and other information are arranged in a concise and usable fashion. A net price list is also furnished with each copy of the catalog, which gives data on locating pins, rest buttons, lock screws and clamps, as well as on drill jig bushings. Copies are offered free by the manufacturer, UNIVERSAL ENGINEERING CO., Dept. TDJ, Frankenmuth, Mich.

Circle Inform-A-Gram No. B39.

ATRAX CARBIDE BURS, for filing and finishing practically any material from plastics to hardened steel, are the subject of the company's interesting Bulletin No. 60-A. Write for it to THE ATRAX CO., 240 Day St., Newington, Conn.

Circle Inform-A-Gram No. B40.

CARBIDE TOOLS AND TIPS. An attractive 20-page catalog, No. 549, describes as to price and size the extensive line of carbide cutting tools fabricated by Tungsten Carbide Tool Co. Solid and tipped tools, made with any of the major grades of carbide, are available in standard sizes or can be made to order. TUNGSTEN CARBIDE TOOL CO., Dept. TDJ, 2661 Joy Rd., Detroit 6, Mich.

Circle Inform-A-Gram No. B41.

A NEW CARBIDE FINISHING MACHINE, the Abrasive No 5 AWF Internal Finisher, accurately grinds and finishes carbides. It is capable of grinding and micro-finishing, at one chucking, several angles or combinations of straight and angular surfaces. Write for illustrated brochure to ABRASIVE MACHINE TOOL CO., Dept. TDJ, E. Providence 14, R. I.

Circle Inform-A-Gram No. B42.

The DI-ACRO Rod Parter further increases the applications of "DIE-LESS DUPLICATING" as a cost-cutting, time-saving production technique so well established by DI-ACRO Precision Benders, Brakes and Shears.

Do you require precision?—DI-ACRO Rod Parter holds tolerance to .001" on duplicated cuts. The ends are square, and roundness is maintained.

Do you want speed?—The Rod Parter exceeds output of other methods with equal accuracy, on rods and bars up to 3/4". Torrington Roller bearings incorporated in an exclusive multiple leverage arrangement provide remarkable ease of operation.

GET "DIE-LESS DUPLICATING" CATALOG! Shows parts produced without die expense by DI-ACRO Benders, Brakes, Shears, Rod Parters, Notchers, Punches.

Pronounced "DIE-ACK-RO"

DI-ACRO PRECISION MACHINERY DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

315 8th Avenue, LAKE CITY, MINN.

CARBIDE DIES are being produced by Cleveland Form Tool Company with the use of a "Visual Grinder", an innovation in the grinding of tungsten carbide. A 14-page, all-illustrated booklet shows examples of the company's die accomplishments along with special applications in carbide tools and wear parts. Write to CLEVELAND FORM TOOL CO., 6514 St. Clair Ave., Cleveland 3, Ohio.

Inform-A-Gram No. B43.

CARBIDE-TIPPED HOLLOW MILLS are offered by Carl Wirth & Son, Inc., in many sizes for a wide range of uses. Midget-type mills are especially constructed for small automatic screw machines. Write for Catalog TD-20 to CARL WIRTH & SON, INC., 1625 Clinton Ave., North, Rochester 5, N. Y.

Inform-A-Gram No. B44.

CIRCLE R TUNGSTEN CARBIDE SAWS (tipped and solid) are available with square and radius cutting tips, in sizes from 2½" to 10" diameter. Other standard and special sizes may be had. For details write CIRCULAR TOOL CO., INC., Dept. TDJ, Providence 5, R.I., and ask for Catalog M.

Inform-A-Gram No. B45.

NEW ALLOY FOR PRECISION CASTING. Cerrocast, a new alloy of reasonable hardness, negligible shrinkage and extensive melting range, has recently been introduced by Cerro de Pasco Copper Corporation. Cerrocast is a non-eutectic alloy of bismuth and tin. It is especially suitable for use in precision casting (Lost Wax Process). Because of its long melting range, Cerrocast can be coined readily to reproduce accurately the shape, dimensions and fine surface details of the master pattern. Literature may be had from CERRO DE PASCO COPPER CORP., 31 Pine St., New York 5, N. Y.
Circle Inform-A-Gram No. B46.

PULLMAX PLATE & SHEET CUTTING MACHINES cut metal of the lightest gauge up to 11/32" thickness by a combination of tool and cutting speed adjustments. A colorful bulletin describing these machines is available. Seven models are pictured, and their capacities and specifications are listed. AMERICAN PULLMAX CO., INC., 2617 N. Western Ave., Chicago 47, Ill.
Circle Inform-A-Gram No. B47.

HI-CYCLIC AIR VALVES make possible the complete control of air cylinder action. They control the stroke of a cylinder within .001". A new four-page folder contains a description of the operating and construction features of these valves, as well as description of various models. Write BECKETT-HARCUM CO., 1140 Wayne Rd., Wilmington, Ohio.
Circle Inform-A-Gram No. B48.

CARBLOX. WEBBER'S CARBIDE GAGE BLOCKS. are designed to avoid wear caused by abrasion as they are wrung and fitted into the work. Because of its extreme hardness, carbide resists wear and retains its accuracy. Carblox are available for immediate delivery in standard sizes and sets, or they can be built to special requirements. Literature may be had from WEBBER GAGE CO., 12903 Triskett Rd., Cleveland 11, Ohio.
Inform-A-Gram No. B49.

CARBO-MILLS, in a new ¼" shank series, are announced in Severance's Bulletin 17-EW. These mills, made of one-piece solid carbide, can be used in portable hand grinders for offhand or precision grinding at high operating speeds. Address SEVERANCE TOOL INDUSTRIES, INC., 730 Iowa St., Saginaw, Mich., for bulletin.
Inform-A-Gram No. B50.

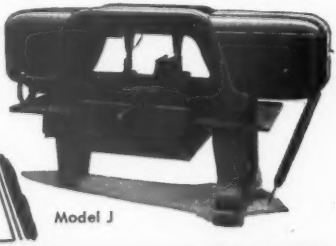
CARBIDE TOOL GRINDING FIXTURES and attachments are presented in a bulletin from K. O. Lee Co. The A645 Tilting Table Attachment is used for rough and finish grinding on single-point, carbide-tipped cutting tools. K. O. LEE CO., 1150 First Ave., S. E., Aberdeen, South Dakota.
Inform-A-Gram No. B51.

That's what you need—greater metal cut-off capacity—to help increase production, a big advantage of the

JOHNSON MODEL J BAND SAW

It cuts 10" rounds, 18" flats. It's sturdy, fast, has extra rigidity that permits higher speed operation and extra accuracy. To decrease your cost of cut-off work, insist on a Johnson Band Saw.

Also a smaller, speedy, lighter Portable MODEL B Saw, with all the accuracy of the larger model. Capacity 5" rounds, 10" flats.



Write for CATALOG!

Model J

JOHNSON MANUFACTURING CORP.
ALBION, MICHIGAN

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PUBLICATION PREVIEWS

STANDARD CARBOLOY TOOLS AND BLANKS are presented in newly released Supplement No. 10 to Carboloy Catalog GT-200. This booklet is devoted to new standard package quantities and new quantity discounts announced by the company. Up-to-date price lists are included along with specifications. CARBOLOY CO., INC., 11111 E. 8-Mile Rd., Detroit 32, Mich.
Circle Inform-A-Gram No. B52.

TARGET GUN DRILLS, with carbide inserts, have been developed for superior deep-hole drilling. A four-page folder is available describing the unique design and construction features of these gun drills. NATIONAL TWIST DRILL & TOOL CO., Dept. TDJ, Rochester, Mich.
Circle Inform-A-Gram No. B53.

GRAND RAPIDS NO. 4 AND NO. 5 UNIVERSAL CUTTER AND TOOL GRINDERS are painstakingly described in a new 16-page publication. Special adaptations and extra equipment are shown along with standard illustrations and specifications. Write GALLMEYER & LIVINGSTON CO., 304 Straight Ave., S. W., Grand Rapids, Mich., and ask for Bulletin GL-1-49.
Circle Inform-A-Gram No. B54.

REXALLOY CAST ALLOY CUTTING TOOLS are fully described in a handy booklet from Crucible Steel Co. of America. Wear strips, tool bits, cut-off blades and tipped tools are pictured. Grinding wheel recommendations and other engineering data are given. CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York 17, N. Y.
Circle Inform-A-Gram No. B55.

THE FIRST NEW IDEA IN
DRILL JIG BUSHINGS...
SINCE
HECTOR WAS A PUP!
MEYCO
Carbide Inserted Bushings
SAVE money 7 ways:
Talk about "earning their keep," look at the ways Meyco Carbide Inserted Drill Jig Bushings will save production costs: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that come close to the prices of ordinary steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. MOTORMAKER SAYS: "High-Speed steel bushings averaged ten days' life, MEYCO bushings, after three months' use, show no signs of wear."
For information and prices write for Meyco Bushing Catalog No. 17.
W. F. MEYERS CO., INC., BEDFORD, INDIANA

FORD CARBIDE ROTARY CUTTERS perform with maximum efficiency in machining almost all materials, including hardened steel. Actual-size illustrations of shapes available are contained in Bulletin C-549. M. A. FORD MFG. CO., INC., 739 W. River St., Davenport, Iowa.
Inform-A-Gram No. B56.

SOLID CARBIDE DRILLS and carbide-tipped drills are the subjects of a supplement to Ace Drill Catalog No. 48. Sizes and list prices are given in this eight-page folder. ACE DRILL CORP., 13835 Jennings Ave., Detroit 27, Mich.
Inform-A-Gram No. B57.

MICRO FINISHING CARBIDE TOOLS. Fine lapping of the cutting edge, to increase the performance of a carbide tool, is discussed in a booklet on lap wheels and hand hones, obtainable from J. K. SMIT & SONS, INC., Dept.. TDJ, Murray Hill, N. J.
Inform-A-Gram No. B58.

THE CARBIDE TOOL NO. 1 GRINDING FIXTURE prevents thermal or grinding cracks in carbide tools by eliminating localized heat. A circular on this fixture may be secured from CARBIDE TOOL CO., 956 Harper Ave., Detroit 11, Mich.
Inform-A-Gram No. B59.

A COMBINED DRILL AND COUNTERSINK, with carbide tip, is announced in new literature. This carbide centerdrill has given excellent results when used for centering tools registering up to 66 on the Rockwell C scale. NATIONAL TOOL SALVAGE CO., 6511 Epworth Blvd., Detroit 10, Mich.
Circle Inform-A-Gram No. B60.

THE HASKINS VB2 FLEXIBLE SHAFT GRINDER drives small carbide rotary cutting, filing and grinding tools at the right speeds for efficient production. For illustrated circular write R. G. HASKINS CO., 605 S. Washtenaw, Chicago 12, Ill.
Circle Inform-A-Gram No. B61.

CARBIDE MATERIALS AND TOOLS of many types are described in Willey's extensive, 66-page Catalog No. 449. A section is also devoted to diamond tools and mechanical dressers. Write WILLEY'S CARBIDE TOOL CO., 1346 W. Vernor Hwy., Detroit 1, Mich.
Circle Inform-A-Gram No. B62.

CARBIDE TOOL GRINDER BULLETIN. Specifications, prices and illustrations of Baldor Tool Grinders and Grinding Wheels are contained in Bulletin No. 341, recently issued. Write for a copy to BALDOR ELECTRIC CO., 4363 Duncan Ave., St. Louis, Mo.
Circle Inform-A-Gram No. B63.

WICKMAN DIAMOND WHEELS, excellent for grinding carbide tools of all kinds, are the subject of a handy-size, 40-page booklet available to interested readers. All necessary specifications and prices are listed. WICKMAN MFG. CO., 15531 Woodrow Wilson, Detroit 3, Mich.
Circle Inform-A-Gram No. B64.

W & B CARBIDE-TIPPED MASONRY DRILLS are presented in a recent four-page circular. These spiral-fluted drills easily penetrate concrete, cement, brick, etc. For full details write for this circular to WHITMAN & BARNES, 10600 Plymouth Rd., Plymouth, Mich.
Inform-A-Gram No. B65.

NICHOLSON CARBIDE BURS are available from stock in nine styles, 26 sizes, and in medium and fine cuts. Catalog No. 3 is just off the press and describes the complete line. Write NICHOLSON FILE CO., 95 Acorn St., Providence 1, R. I.
Inform-A-Gram No. B66.

TUNGSTEN CARBIDE POINTS are available for direct attachment to Vinco Automatic Center Punches. The carbide permits marking of hard steel with these punches. Descriptive literature is obtainable from VINCO PRODUCTS, Asbury Park 1, N. J.
Inform-A-Gram No. B67.

TOSCO CARBIDE - TIPPED TOOLS both standard and special, are described as to size and price in a well illustrated, two-color catalog, No. 11. TOOL SPECIALTY CO., 1011 E. Slauson Ave., Los Angeles 11, Calif.
Inform-A-Gram No. B68.

Now
New design for precision boring of small, long, concentric holes without taper
Bore them with BOKUM'S new SOLID TUNGSTEN CARBIDE tools

Here's a new development in tools that enables you to bore small diameter holes to extreme depth with precision. Here's a boring tool with great rigidity. Cutting heads and shanks are made of two different grades of carbide. Shank diameters range from ⅜" to ½". Here is the last word in precision boring—rendering still more valuable the recognized features of Bokum Boring Tools which (1) retain clearance throughout life, (2) require resharpening only on face.

Send for Bulletin E-948

BOKUM TOOL CO.
14775 WILDEMERE AVE. · DETROIT 21, MICH.
SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PUBLICATION PREVIEWS

TUNGSTEN CARBIDE-TIPPED TOOLS of many types are illustrated in a brochure available from Harrington Tool Company. The company can produce special grooving tools, form tools, boring tools, circular saws, end mills, extrusion dies, broaches and many other special hard-to-make tools. HARRINGTON TOOL CO., 21810 Wyoming at Leslie, Detroit 20, Mich.
Circle Inform-A-Gram No. B69.

KELLER CARBIDE BURRS are featured in the latest Pratt & Whitney Catalog. **Actual-size** illustrations, specifications and descriptions are included for a variety of shapes and sizes. PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Circle Inform-A-Gram No. B70.

PROSSER CARBIDE TOOL GRINDERS are presented in a circular now being distributed. Described and pictured are Grinder Models AA and EE as well as the Chip Breaker Grinding Attachment, the Drill Grinding Attachment, the Diamond Truing-Tool and Feed Screw, and the Radius Dresser Attachment. THOMAS PROSSER & SON, Dept. TDJ, 120 Wall St., New York 5, N. Y.
Circle Inform-A-Gram No. B71.

CARBIDE-TIPPED CUTTING TOOL CATALOG. The new Nelco Tool Catalog pictures, describes and lists side milling cutters, end mills, twist drills, masonry drills, and other standard and special tools. For a free copy write NELCO TOOL CO., Dept. TDJ, Manchester, Conn.
Circle Inform-A-Gram No. B72.

SMOOTH and SQUARE
for Layout, Inspection, Assembly

CHALLENGE LAYOUT SURFACE PLATES

Precision ground or planer finished, Challenge Layout Surface Plates provide a perfect surface. Sizes range from 12"x18" to 54"x144". All are made of semi-steel. Standard plate thickness is 6". All-steel stand is arc-welded for rigidity and has special leveling screws to level the plate and lock it securely. Plates of 8" thickness, special sizes, grooving, scoring, machining and slotting furnished on order. Write for full data on this and other Challenge equipment.

THE CHALLENGE MACHINERY CO., GRAND HAVEN, MICH.

SURFACE PLATE EQUIPMENT
UNIVERSAL IRONS—4 Sizes V-BLOCKS—7 Sizes
ANGLE PLATES—22 Sizes BOX PARALLELS—18 Sizes

THE LITTLE HUSTLER CONVEYOR is small, easily portable and fully adjustable. An eight-page bulletin from the manufacturer, May-Fran Engineering, Inc., illustrates and details the uses of this conveyor. By use of two or more "Little Hustlers", many short run setups can be made without manhandling the workpieces. Complete specifications are listed. MAY-FRAN ENGINEERING, INC., 1710 Clarkstone Rd., Cleveland 12, Ohio, will send free copies
Inform-A-Gram No. B73.

A NEW 18" FACE GRINDER is announced in Circular F, just published by Abrasive Machine Tool Co. A 15 hp, 900 rpm motorized spindle eliminates all pulleys and belts, and furnishes exceptionally powerful drive. Write ABRASIVE MACHINE TOOL CO., Dept. TDJ, E. Providence 14, R. I.
Inform-A-Gram No. B74.

THE ROTO - MASTER CARBIDE GRINDER makes roughing and finishing operations with carbide rotary files available at a modest price. Literature describing this 38,000 rpm hand grinder may be secured from METAL REMOVAL CO. 1016 N. Ashland Ave., Chicago 22, Ill.
Inform-A-Gram No. B75.

CARBIDE-TIPPED GENESEE ADJUSTABLE HOLLOW MILL BLADES are described as to prices and specifications in a new data sheet. Carbide-tipped facing and counterboring toolblades are also described. Write GENESEE MFG. CO., INC., Dept. TD, 141 N. Water St., Rochester, N. Y.
Circle Inform-A-Gram No. B76.

INVERTED SOLID CARBIDE TOOLS are presented in The Viking Tool Catalog No. 2-49. Specifications, dimensions and prices are given for clamped tools for turning, facing, lathe work and other operations. THE VIKING TOOL CO., Dept. T & D, Nichols Rd., Shelton, Conn.
Circle Inform-A-Gram No. B77.

CARBIDE-TIPPED TOOLS, designed to provide strength and rigidity to the securely brazed-in tungsten carbide tips, are presented in the Whitman & Barnes Catalog No. 101. Many types of drills, reamers and special tools are described. WHITMAN & BARNES, 10600 Plymouth Rd., Plymouth, Mich.
Circle Inform-A-Gram No. B78.

CARBIDE METAL BLANKS AND CARBIDE-TIPPED TOOLS are featured in the latest edition of Carmet Standard Catalog C-2. Standard blanks, standard tools and special shapes are pictured and discussed. Address ALLEGHENY LUDLUM STEEL CORP., Dept. TD-83, Pittsburgh, Pa.
Circle Inform-A-Gram No. B79.

A FULL LINE OF SOLID CARBIDE BLADES for all uses is described in Wesson Company's latest literature. These blades take full advantage of carbide. Write for this illustrated booklet to WESSON CO., Woodward Heights at Ruckel, Ferndale 20, Mich.
Circle Inform-A-Gram No. B80.

VITRIFIED - BONDED DIAMOND WHEELS are made by Norton Co. for sharpening single-point carbide tools. These wheels combine the fast cutting qualities of resinoid-bonded wheels with a resistance to wear and grooving approaching that of metal-bonded wheels. Literature may be had from NORTON CO., 1 New Bond St., Worcester 6, Mass.
Inform-A-Gram No. B81.

FIRTHITE TIPS AND BLANKS, manufactured to uniformly close tolerances, are covered in Catalog Sections 60-010 and 60-011. Illustrations, sizes and latest prices are included for all standards, modified standards, semi-standards and modified semi-standards. FIRTH STERLING STEEL & CARBIDE CORP., 2201 Demmler Rd., McKeesport, Pa.
Inform-A-Gram No. B82.

CARBIDE AND ABRASIVE PRODUCTION TOOLS are presented in a new eight-page catalog from The Metal Removal Co. This catalog, No. 20, describes carbide burs, mounted wheels, mandrels and other products. Write THE METAL REMOVAL CO., 1016 N. Ashland Ave., Chicago 22, Ill.
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The new Master-Cut Blade, made of high speed steel, offers you definite advantages which pay out handsomely. The proper rake angle enables the teeth to cut ferrous or non-ferrous materials faster. Uniform side clearance avoids binding and friction. M. & M. Dual Drive Adaptors lengthen life and eliminate breakage. Our distinctive flat hub, thinner than the cutting edge, makes for rigid holding
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Ask for Bulletin 220-J
PENTON BUILDING
CLEVELAND 13, OHIO
AT YOUR COMMAND · AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PUBLICATION PREVIEWS

RUSCOT CARBIDE AND HIGH PRODUCTION TOOLS are offered in an illustrated circular published by the manufacturer, Ruscot Tool & Engineering Co. The company makes a complete line of cemented carbide and high speed steel tools, of solid or inserted blade types, to customers' specifications. For a copy of this interesting literature write to RUSCOT TOOL & ENGINEERING CO., 1900 E. 9-Mile Rd., Ferndale 20, Mich.
Inform-A-Gram No. B84.

THE MAGNA-SINE 20" SERIES for production surface grinders is announced by Omer E. Robbins Co. in newly released literature. Thus, it is now possible to have a magnetic chuck on production machines that is quickly and accurately set up for parallel or angular work. Illustrations, dimensions and other particulars are included. Address OMER E. ROBBINS CO., 5722 12th St., Detroit 8, Mich., for a copy of this literature.
Inform-A-Gram No. B85.

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CEMENTED CARBIDES CATALOG. The latest edition of the Kennametal catalog contains 76 pages of information on cemented carbide tools and blanks of all types. Visually indexed, this catalog also gives detailed descriptions of Kennametal compositions. Write KENNAMETAL INC., 500 Lloyd Ave., Latrobe, Pa.
Inform-A-Gram No. B86.

CARBIDE "BRAZE-CUTS", available from Service Diamond Tool Co., eliminate the brazing bottleneck by cutting tips with scissors. A data sheet lists dimensions, materials and prices. SERVICE DIAMOND TOOL CO., 2505 Burdette Ave., Ferndale 20, Mich.
Inform-A-Gram No. B87.

ELMES HYDRAULIC PRESSES are covered in a 12-page bulletin, No. 1010-B, issued by the manufacturer, Elmes Engineering Division of American Steel Foundries. Electric control gives semi-automatic operation, automatic operation, and inching with speed change and reversal of slide governed either by ram travel or pressure, whichever is preferable. Write for a free copy of this bulletin to ELMES ENGINEERING DIV. OF AMERICAN STEEL FOUNDRIES, Dept. TDJ, Cincinnati 29, Ohio.
Inform-A-Gram No. B88.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

FIRTHITE TOOLS, including finished standard general-purpose tools and standard boring tools and bits, are featured in a brand new price list, designated Catalog Sections 60-100 and 60-101. Specification data, sizes and prices are contained in this two-color booklet. Address FIRTH STERLING STEEL & CARBIDE CORP., 2201 Demmler Rd., McKeesport, Pa.

Circle Inform-A-Gram No. B89.

NORBIDE-NORTON BORON CARBIDE— is the extremely hard material for use in dies, gages, anvils, nozzles and abrasives. A multicolored brochure discusses the manufacture of Norbide, its characteristics and its applications. NORTON CO., 1 New Bond St., Worcester 6, Mass.

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SOLVOL LIQUID CUTTING COMPOUND is the subject of a free D. A. Stuart publication. Machining operations on which the use of Solvol has shown superior results include drilling, reaming, milling, etc., with carbides and high speed steel. D. A. STUART OIL CO., LTD., 2727 S. Troy St., Chicago 23, Ill.

Inform-A-Gram No. B91.

LOTENS WHEELS FOR CARBIDE TOOL WORK are featured in new literature. Some of these wheels are made in "Cavity Clearance" Structure No. 15, which has application to both the roughing and semi-finishing operations. Write PRECISION GRINDING WHEEL CO., INC., 8301 Torresdale Ave., Philadelphia 36, Pa.

Inform-A-Gram No. B92.

THE MAXWELL PRECISION BORING HEAD, an accurate tool featuring .0002" adjustment and ⅜" to 15" boring capacity, is described in a circular just published by The Maxwell Co. This boring head comes in three sizes and is available with any standard shank. Address requests for this illustrated literature to THE MAXWELL CO., 225 Broadway, Bedford, Ohio.

Inform-A-Gram No. B93.

WELDON TOOLS are described and illustrated in a comprehensive, 78-page book designated Catalog No. 8-B. Dimensions, prices and other data are given for high speed cut-off tools, counterbores, end mills, form tools, etc. All of these tools are available with carbide tips. For this extensive catalog write to THE WELDON TOOL CO., 3002 Woodhill Rd., Cleveland 4, Ohio.

Circle Inform-A-Gram No. B94.

CARBIDE-TIPPED ROUND TOOL BITS with flat holding surfaces are shown in a new data sheet from Formed Tools Co. These round tools fit precisely and effect an accurate cut. They do not shift under cutting force. Write for this literature to FORMED TOOLS CO., 43043 Grand River Ave., Farmington, Mich.

Circle Inform-A-Gram No. B95.

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Speed — 500 R.P.M. Feed 15" P.M. Compare these results:
TIME With high speed cutters 3½ min. With Nelco Carbide-tipped cutters 1½ min.
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THE blanks shown are milled six at a time with Nelco Carbide-tipped Face Mill No. 8106F. The floor to floor time is 1½ min. compared with 3½ min. with the high speed cutters formerly used. When all manufacturing costs including costs of tips, costs to re-grind, cost to re-tip and grind, and the cost of the cutters per piece have been compared with similar costs for high-speed cutters, the figures are .114 cents per piece with Nelco Carbide-tipped tools against .334 cents per piece with high-speed tools. This is one of many examples of the way in which Nelco users are saving hundreds of valuable production hours and lowering their costs.
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For that extra edge in production
WRITE for descriptive literature and name of your Nelco Distributor.
NELCO TOOL CO., INC., Manchester, Conn.

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

that breakage and replacement have been kept at a minimum.

After three years of operation, this die still has an additional life expectancy of 163,000,000 sets of laminations, but to be extremely conservative and as a basis for calculating costs of dies for other carbide applications, General Electric reports that the net savings of this type of die after production of 50,000,000 sets of parts will be $66,415.00, and that at 10,000,000 sets the net savings are $2,568.00 against the use of high carbon, high chrome steel dies. Obviously carbide lamination dies are no longer simply a possibility but an economical necessity where production requirements exceed 10,000,000 sets of parts.

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The Tool & Die Journal Directory of Carbide Products and Manufacturers

Every effort has been made to make this directory as extensive and complete as possible. Questionnaires, sent to all carbide and carbide tool manufacturers of record, were returned by 131 manufacturers, many of whom supply from 50 to 100 of the products classified.

Each page carries a section of the alphabetized products and of the manufacturers names. The manufacturers named in bold type are advertisers in this issue, and by reference to the Advertisers' Index on page 135, additional information can be had as to their carbide offerings.

TO USE THE DIRECTORY: On this first page, you will note under BORING BARS, Tipped, Brazed, that there are 42 manufacturers. Names and addresses of the 42 are given on the lower part of this and the following six pages.

If the value to you of this quick-reference source-of-supply directory is commensurate with the effort expended in compiling it, we will feel that it is in keeping with our 1st Annual Feature issue.

The Editors.

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[9] The Sheffield Corp.
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[13] Tungsten Carbide Tool Co.
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[17] Barber-Colman Co.
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[18] **The Standard Electrical Tool Co.**
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[19] Action Diamond Tool Co.
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[20] Metro Tool & Gage Company
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[25] **Ace Drill Corporation**
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[26] **Cleveland Form Tool Co.**
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[28] **E. F. Hager & Son**
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[31] Acme Tool Company
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New York 7, N. Y.

[32] Tool Engineering & Mfg. Co.
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Providence, R. I.

[33] Vinco Products
Asbury Park 1, N. J.

[34] Sandstrom Carbide Products Co.
2047 Post Rd.
Warwick, R. I.

[35] Gem Tool Co.
4711 North 125th St.
Butler, Wis.

[36] The Viking Tool Company
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(P. O. Box 286)
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[37] The Ingersoll Milling Machine Company
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[38] Precision Grinding Wheel Co., Inc.
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[39] South Bend Lathe Works
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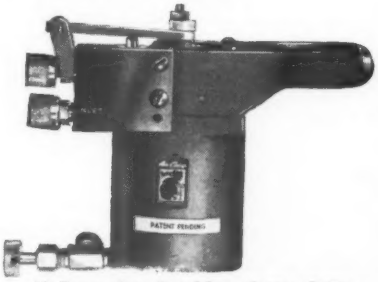

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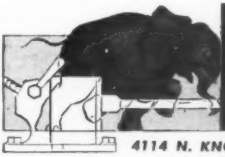

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THE TOOL & DIE JOURNAL DIRECTORY OF.....

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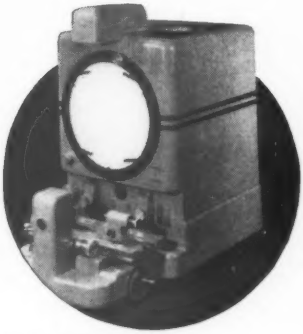

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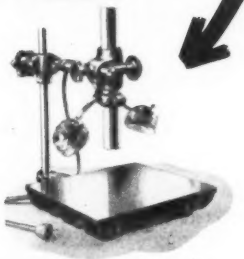

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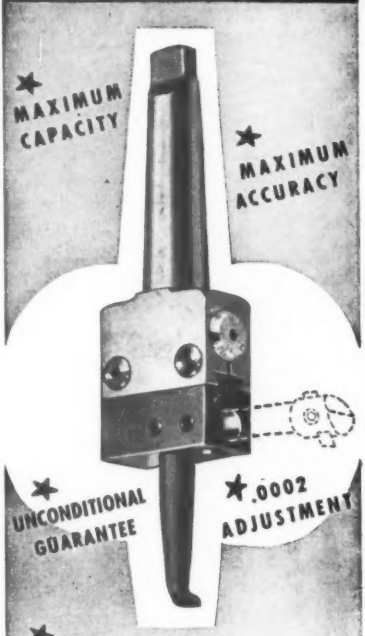

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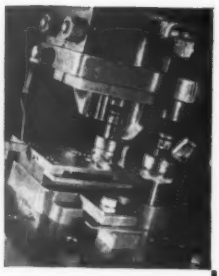

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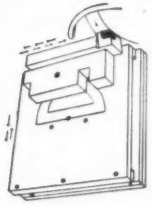

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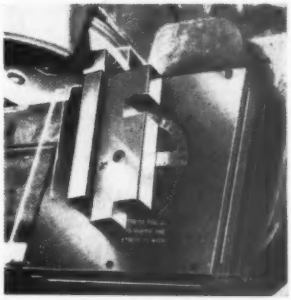
ADJUSTABLE WAYS
WAYS ARE HARDENED



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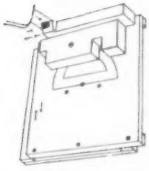

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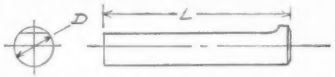

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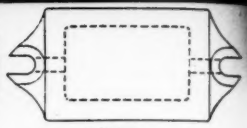

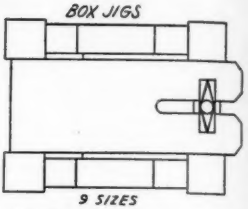

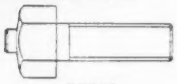

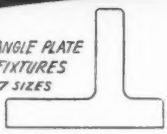

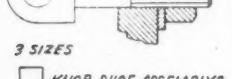

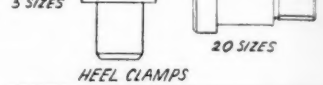

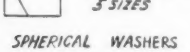

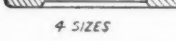

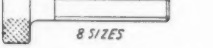

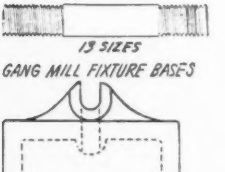

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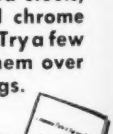

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INFORM-A-GRAM KEY NUMBERS

Society of Carbide Engineers

The Society of Carbide Engineers was founded in Hartford, Conn. in Sept., 1946. Since its inception the Hartford Chapter has grown from a charter membership of 25 to its present size of 75. This group includes carbide application supervisors and executives, service engineers of carbide tool manufacturers, and allied personnel concerned with direct fabrication of carbides, such as tool grinding, and die room supervisors, grinding wheel service engineers, etc. The original charter members represented the most progressive carbide men in the Hartford area with representation from such outlying sections as Springfield, Worcester, and Greater New York. The common interests of carbide fabrication and application have drawn inquiries and members from a wide area.

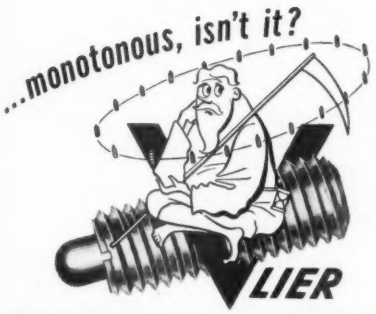
The Society was organized primarily, "for the advancement of knowledge and application in the field of carbides and the means and methods of applying such knowledge in practice, and education in such knowledge and practice; and within this field of carbides alone to promote and through its members engage in research, writing, publishing, and dissemination of such knowledge". The purpose stated as above shows the high specialization of the group. Carbides alone, their uses, application, and fabrication are the main interests of the Society. The enormous new fields of wear, impact, heat resistance, as well as the cutting tool and die applications require specialists not only well versed in carbides, but in the machine tool design and engineering fields as well.

As in all past practices of new tool development, specifically high speed steels and cast alloys, the carbide tool engineer has and must for some time to come adapt this product to present day machines and conditions. This has required a good deal of non-standard practice or specialized handling of each individual case. As the knowledge of carbide performance increases and the machinery manufacturer meets the high speeds, rigidity, and precision required, then a new set of carbide standards may be arrived at for the majority of tooling. The Society of Carbide Engineers will serve as a focal point for the dissemination of all the knowledge that can be collected within the various chapters. It is unusual for any group to be as highly specialized but it should be noted that the manufacturers successfully using carbides today have trained men specializing in this field and this field only. They have recognized the importance of disassociating their carbide group of tooling, grinding, application, and control from other types of and control from other types of tooling.

The Society at present is carrying out some of its educational aims in a four page folder type publication, published under the title of Carbide Tips. This publication carries the Society's business transactions, resume of monthly talks on carbide tooling, technical articles by members, reprints from trade magazines, new products, and shop "kinks". The technical and reprint items are given approximately 75% of the space. Some of the technical items covered in the first few publications are Theory of Negative Rake Cutting, Chip Control by Grinding, and a reprint of Hardness Testing of Carbides. The first issue, in order to clarify subsequent classification in all technical articles, carried a comparative grade chart. This highly controversial issue was solved in a series of meetings and the resultant Grade Chart was selected as a consensus of manufacturers and users recommendations. It actually was the first in a series of standards the Society is attempting to establish and publish.

In order to further stimulate interest and supply material for the publication a yearly prize of $50.00 is offered for the best article submitted on carbide application. All entries become the property of the Society. Present contest closed Dec. 8th. The author may submit as many articles as he wishes and he does not have to be a member of the Society to participate.

The past year has brought the establishment of two new chapters: the Worcester Chapter founded in April with 30 members; and the Boston Chapter started in October with 23 members. These have grown to 55 and 52 members respectively. Inquiries on chapter organization have been received from other areas such as New York City, Detroit and Rochester. Although a newcomer in the field of Technical Societies, the growth of the Hartford Chapter and the interest shown throughout the country indicate the probability of a national organization.



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SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

. . . Machine Tool Builders

also increased the need for the skilled toolmakers, production engineers and maintenance men. The more a machine produces per hour, the greater the loss when it is shut down for any reason. These auxiliary services are to be even more important in the future than they were in the past. The worker is not to become a mere cog in a vast establishment. A larger proportion of our employees will have to possess a far higher degree of skill than ever before.

Ramifications

The above constitutes only a partial list of the ramifications engendered by the development of today's carbide tools.

In addition to stimulating the entire machine tool industry, they are putting the motor, electrical, steel, petroleum and other industries to work. The big question today is, of course—are all these developments catching up with carbides?

While machine tool builders are ready today to utilize present-day carbides to the utmost, all experience teaches us that the situation will not remain in balance. Just around the corner are new developments, perhaps in better coolants, who knows? Many research engineers are probing the unknown and are determined to open up new possibilities.

Will history repeat itself? Will the cutting tool industry again produce cutting tools superior to today's, and maintain its perpetual challenge to the machine tool industry?

We not only hope, but assume, that such will be the case. For *it is the cutting tool itself that does the work.* As fast as better cutting tools are developed, it is the job of the machine tool industry to devise ways and means of utilizing them to their fullest potentialities.

However, it must always be borne in mind that the end results of better cutting tools and better machine tools are realized *only if and when they are put to work in the shop.* The degree of obsolescence of the nation's present metalworking equipment is appalling. Only by consistent replacement of old machines by new models can the country actually gain the benefits of progress and modernization.

. . . Carbide Die Grinding

Since carbide is stiffer and more brittle than steel, precision grinding of holes is particularly essential with carbide dies. The punches must be accurately centered in the die openings to avoid chipping.

Shops making progressive and compound dies have found that using the jig grinder is the easiest way to obtain precise location of holes in carbide die sections and correct alignment of all die elements. The polar coordinate system used by this machine makes it possible to grind production holes, round die openings, dowel holes, bushing holes, stripper holes, punch retainer holes and guide-pin holes to within a "tenth" or better for location. Correct draft or taper can also be ground, reducing the lapping problem.

If the holes in the steel elements are first jig bored, and both these and the holes in the carbide parts are then jig ground, interchangeability is assured.

Since carbide die sections are seldom over 1" thick, very small holes can be ground on the jig grinder with diamond-charged mandrels or diamond-impregnated quills. However, if the section must have several small holes at precise locations, it is perhaps better to make the opening large enough to be bushed, if space permits. This method is particularly practical when the following conditions are taken into account: 1) small holes in preformed nibs are often off location; 2) it is easier to grind the larger holes with larger wheels to exact location and size; 3) a bushing can be replaced if the piercing hole is chipped.

Many shops have found that contour grinding in the jig grinder is practical for complex punch and die shapes, when the blank contour is made up of definitely dimensioned radii and tangents.

Once again it should be pointed out that the life of a carbide die is more dependent on workmanship and inherently accurate methods than is the case with steel dies. The use of inexpensively and easily made diamond charged forming wheels not only effects substantial savings in time and materials cost, but provides for closer accuracy because of the method of forming. Precise location and correct alignment of die elements is assured by the polar coordinate system used by the jig grinder.

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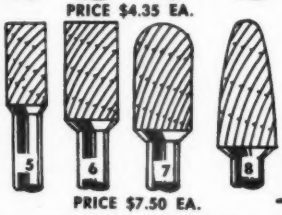

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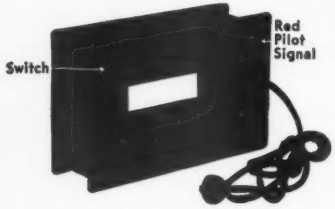

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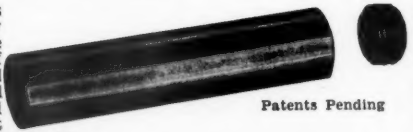

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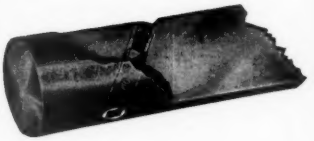

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HINTS ON PROPER USE OF CARBIDE TOOLS, recommended grades and speeds for machining various materials with carbide-tipped tools, and other valuable data are contained in Catalog No. 48-T, from Metal Carbides Corp., producer of "Talide". This publication also lists specifications and prices for all standard Talide-tipped tools and Talide tips. For a copy write METAL CARBIDES CORP., 101 E. Indianola Ave., Youngstown 5, Ohio.
Circle Inform-A-Gram No. C1.

CARBIDE SINGLE-POINT TOOL PRACTICE is covered by a new set of six educational, discussion-type slidefilms available from Carboloy Co., Inc. Each set of films, covering such subjects as "What Is Cemented Carbide?" and "Brazing Carboloy Tools", is contained in a kit that also includes six booklets supplementing the material presented in the films. The booklets contain sections from the Carboloy tool manual. Price of the complete kit, containing the six slidefilms, the six technical booklets and a booklet on how to obtain best results with slidefilms, is $15.00. Extra copies of the booklets may be had for 10 cents a copy. Contents of a complete kit are illustrated at the bottom of this page. CARBOLOY CO., INC., 11111 E. 8-Mile Rd., Detroit 32, Mich.

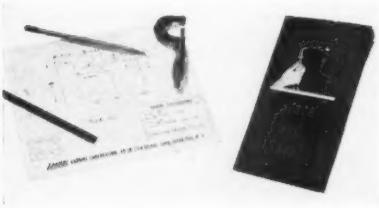
"GRINDING CARBIDE TOOLS" is the title of a 130-page handbook of practical information available from Norton Company. Section titles include "Wheels for Grinding Carbide Tools", "Grinding Single-Point Tools", "Hand Honing of Carbide Tools", "How to Get the Most From Your Diamond Wheels" and "Centralized Control and Grinding of Carbide Tools". A wealth of general information is also contained in the last section of this manual. A 16 mm. sound-and-color film, with the same title, can be obtained by foremen groups, technical societies, etc. NORTON CO., 1 New Bond St., Worcester 6, Mass.
Circle Inform-A-Gram No. C2.

"PLANING WITH CARBIDES" is a handy, 44-page manual available from The Cincinnati Planer Co. Some of the important subjects discussed are "Success or Failure in Planing With Carbides", "Carbide Grade Selection", "Speeds and Feeds" and "Brazed and Clamped-On Tips". An interesting section is devoted to performance data and illustrations. Dealing with a relatively little-publicized subject, this manual is a "must" for those involved in planing with carbides and those that should be. THE CINCINNATI PLANER CO., Dept. TDJ, Cincinnati 9, Ohio.
Circle Inform-A-Gram No. C3.

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

SHOP AIDS

"BRAZE AND SAVE" is a handy, 12-page booklet giving complete instructions on how to braze carbide with maximum efficiency and economy. This Adamas Carbide publication describes the equipment and materials required in brazing by torch, furnace or induction, and how to "sandwich" braze. Explanatory drawings accompany descriptions of all operations. Also available from Adamas is the "Sketch and Spec Pad", a bound pad that has a generous supply of cross-section paper and is designed primarily to assist in ordering preformed blanks. The standard tolerances indication, over-size manufacturing allowances and a specification box with space for all required information are found on each page. For these handy carbide aids, address ADAMAS CARBIDE CORP., Box 149, Harrison, N. J.



Circle Inform-A-Gram No. C4.

THE DIRECT-READING POWER CHART and Drilling Time Indicator provides a convenient, time-saving, pocket-size visual calculator for use in estimating and engineering departments. It may be secured by writing to THE CINCINNATI BICKFORD TOOL CO., 3220 Forrer St. South, Cincinnati, Ohio.

Circle Inform-A-Gram No. C5.

"THE FACTS OF LIFE ON AIR AND HYDRAULIC DEVICES" is now in its second printing. This free, pocket-size booklet presents the "Do's", "Don'ts" and "What To Look For" phases of setting up and servicing this type of equipment. LOGANSPORT MACHINE CO., INC., 820 Center Ave., Logansport, Ind.

Circle Inform-A-Gram No. C6.

"WHY DIES BREAK" is the title of a series of articles featured in Lindberg's "Heat Treating Hints". Vol. VII, No. 1, contains an interesting installment on "Effects of Furnace Atmosphere and Heating Mediums". Write LINDBERG ENGINEERING CO., 2444 W. Hubbard St., Chicago 12, Ill.

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INSTRUCTIONS FOR SAFE OPERATION OF GASOLINE FORK TRUCKS are contained in a new publication. Twenty-five hints, each illustrated with a small drawing, are included. Write for Bulletin P1170 to THE YALE & TOWNE MFG. CO., Dept. K, Roosevelt & Haldeman Aves., Philadelphia 15, Pa.

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A NEW CARBIDE APPLICATION CHART has just been published by Adamas Carbide Corp. All tungsten carbide manufacturer's grade recommendations for chip removal, wear and impact applications are contained in this chart. It was prepared as a result of a survey made by the Carbide Industry Standardization Committee, in which manufacturers were asked to recommend the grade or grades of their product best suited for specific applications. The chart features a set of symbols, C-1 through C-14, to indicate each application. Free copies are obtainable from ADAMAS CARBIDE CORP., Box 149, Harrison, N. J.

Circle Inform-A-Gram No. C9.

TOOL SETUP APPLICATIONS of carbide inserts (square, rectangular, round, triangular) are shown by six pages of line drawings with speed and feed tables in a Weadock Tool Co. bulletin. Applications cover straight turning, plunge cutting, form cutting, straddle and facing, swing turning, threading, planing, and grooving, to mention only a few. Standard and special applications are detailed, along with drawings and recommendations covering chip breaker grinds. This tool manual will help the tool designer in fitting the tools to the job. Write WEADOCK TOOL CO., 111 Weadock North, Saginaw, Mich.

Circle Inform-A-Gram No. C10.

"A CARBIDE DIE—ITS COST AND PERFORMANCE", by Herbert Harig, is now available as a TOOL & DIE JOURNAL reprint. This article favorably compares the initial and maintenance costs of a carbide transformer lamination die with those of a tool steel die of the same type. For a copy write HARIG MFG. CORP., 321 N. Albany Ave., Chicago 12, Ill.

Circle Inform-A-Gram No. C11.

USEFUL HINTS ON CARBIDE GRINDING with Wickman Resinoid and Wickman-Neven Steel-Bonded Diamond Wheels are offered in a new folder from the manufacturer. Reasons for using diamond wheels and methods by which they can be used to best advantage are presented. WICKMAN MFG. CO., 15531 Woodrow Wilson, Detroit 3, Mich.

Circle Inform-A-Gram No. C12.

A COMBINATION DECIMAL EQUIVALENT CHART AND 1950 CALENDAR is available from Dayton Rogers Mfg. Co. The chart is printed in two colors and can be easily read at a distance. Two sets will be mailed in response to each request on company letterhead. DAYTON ROGERS MFG. CO., 2824 13th Ave. South, Minneapolis 7, Minn.

Circle Inform-A-Gram No. C13.

METHODS MANUAL FOR CARMET CARBIDE TOOLS. This valuable book contains recommendations for correct grades, speeds, feeds and cuts, hints on setup of Carmet tools; grinding procedure; and brazing instructions. Write ALLEGHENY LUDLUM STEEL CORP., Dept. TD-83, Pittsburgh, Pa.

Circle Inform-A-Gram No. C14.

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SHOP AIDS

THE WEBBER THERMAL COMPARATOR measures the expansion of dissimilar metals and gives instant reading of the difference between the gage blocks and the workpiece at various shop temperatures. Thus, the exact size the part should be made can be quickly determined by this slide rule comparator. The upper half is for use with steel blocks and the lower, with carbides. The Thermal Comparator, which is now included with all

Webber Carbide Gage Block Sets, is available separately at $1.00 each from THE WEBBER GAGE CO., 12903 Triskett Rd., Cleveland 11, Ohio.

TIPS ON USING CARBIDE FILES AND BURS are contained in the new Nicholson Catalog No. 3. Recommended speeds are tabulated, and proper care of burs is outlined. Write to NICHOLSON FILE CO., 95 Acorn St., Providence 1, R. I.
Circle Inform-A-Gram No. C15.

KODAGRAPH AUTOPOSITIVE PAPER is a new silver-sensitized photographic paper for engineering drawing reproductions that offers the advantages of photography in reproduction—the ability to increase contrast beyond that of the original, to reproduce opaque as well as translucent drawings, and to provide long-lived, non-fading images. This paper gives a positive directly—black lines on white paper—without going through the usual negative step. It may be handled in normal room light. Opaque drawings, old tracings, blueprints and new drawings can be reproduced with new legibility and over-all quality. A brochure on this material may be had from EASTMAN KODAK CO., Dept. TDJ, Industrial Photographic Div., Rochester 4, N. Y.
Circle Inform-A-Gram No. C16.

MACHINING WITH CARBIDES. Data sheets are now available that give tabulated recommendations for machining steel, ferrous alloys, and non-ferrous and non-metallic materials with Willey's Metal. WILLEY'S CARBIDE TOOL CO., 1346 W. Vernor Hwy., Detroit 5, Mich.
Circle Inform-A-Gram No. C17.

BRAZING, one of the two methods of attaching carbide tips to tools, is defined and described in Vol. 4, No. 10, of Tempil Topics. The process is completely detailed as to operations performed and materials used. TEMPIL, 132 W. 22nd St., New York 11, N. Y.
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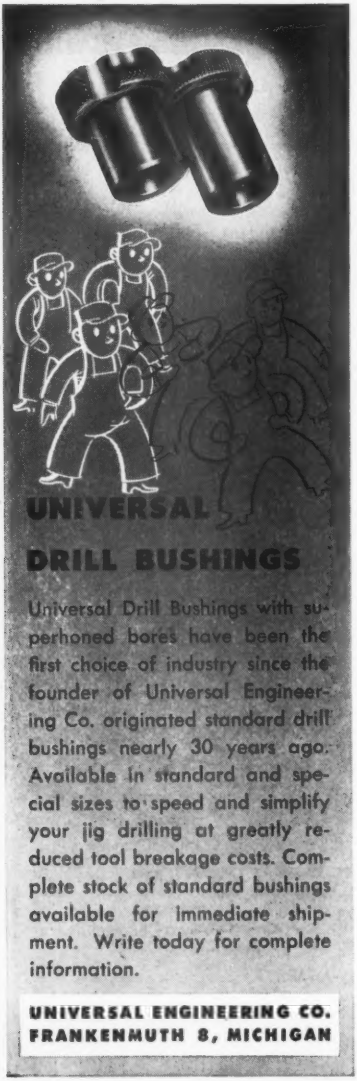
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The Metal Cutting Tool Manufacturers, through these various activities, hope to continue to contribute to the forward march of American industry. They realize that industry can move forward only when better tools, better tooling methods and consequently greater manufacturing economies are realized.

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Ace Abrasive Laboratories, Inc., 1 Spruce St., New York 7, N. Y., manufacturers of STAR DUST laboratory graded diamond powders and lapping compounds, announce an expansion of facilities. This expansion will speed up the production of accurately graded abrasives. STAR DUST abrasives offer extremely fine particle sizes within close tolerances. Literature is available on request. Circle **Inform-A-Gram No. D9.**

Correction

In the article "Standard Clamping and Holding Devices", published in the November, 1949, issue of TOOL & DIE JOURNAL, an error occurred in the statement giving the holding pressures for the De-Sta-Co clamps built by Detroit Stamping Co.

The recommended holding pressures for their light duty models range from 200 to 650 pounds, depending on the size of the clamp. The recommended holding pressures for the medium duty models range from 475 to 775 pounds, and the recommended pressures for the heavy duty models range from 825 to 1450 pounds; however, the maximum holding pressure of the large, heavy duty model is 1600 pounds.

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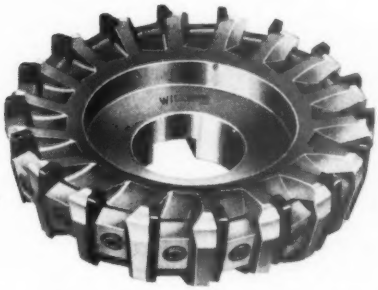

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FONDA LIFETIME-CARBIDE GAGE BLOCKS, shown in both rectangular (left) and square sets, outlast steel blocks in wear and accuracy. Time between inspections is greatly extended, thereby reducing this expense. They are guaranteed not to grow or shrink over any period of time. Write FONDA GAGE CO., INC., 59 Daly St., Stamford, Conn.
Circle Inform-A-Gram No. A1.

THE SEVERANCE CARBO-MILL LINE now includes a new ¼" shank set. The Carbo-Mill is a tool manufactured of solid carbide throughout. The new set will be furnished in a Visi-Case and comprises the 10 most popular shapes. When dull, these tools can be reground at a very small cost. For complete details write SEVERANCE TOOL INDUSTRIES INC., 730 Iowa St., Saginaw, Mich.
Circle Inform-A-Gram No. A2.

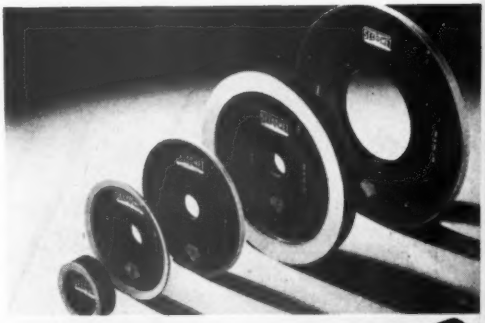
CARBIDE-INSERTED SHELL END MILLS of a new type (left) are announced by Wendt-Sonis Co. They are designed for facing or milling to a shoulder and can operate at higher feeds and speeds. These new tools have more teeth in the cutters, allowing for increased table feed per minute and freedom of cutting action. Tools wear evenly because of the uniform blend of carbide used for the inserts. WENDT-SONIS CO., Dept. A, Tenth & Collier Sts., Hannibal, Mo.
Circle Inform-A-Gram No. A3.

CARBIDE HEADING HAMMERS WITH MARKINGS. Combination bolt heading and marking hammers of solid carbide for automatic bolt heading machines are now available. The new hammers make it possible to eliminate the separate marking operation frequently performed in the manufacture of bolts, rivets, etc. The use of carbide assures clean markings over long runs. CARBOLOY CO., INC., 11111 E. 8-Mile St., Detroit 32, Mich.
Circle Inform-A-Gram No. A4.

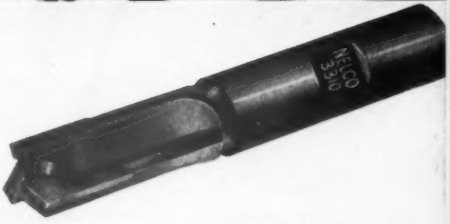
MODEL WD-10 WET OR DRY CARBIDE TOOL GRINDER features Hammond's patented "No Spray—No Splash" guards, which permit unrestricted vision but keep operator and floor dry. The 10" x 19" tables are adjusted to any angle from 15 degrees above to 30 degrees below horizontal. A safety cup disc completely fills the open cup of the wheel and prevents injuries or dropping of tools into cup. HAMMOND MACHINERY BUILDERS, INC., 1631 Douglas Ave., Kalamazoo 54, Mich.
Circle Inform-A-Gram No. A5.

ON PARADE

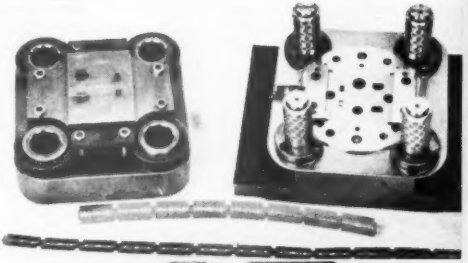
SECOMET RESINOID BONDED DIAMOND WHEELS, made by J. K. Smit & Sons, Inc., are being used widely for the grinding of carbide-tipped tools in large quantities, or on a production basis. Their extremely fast cutting action provides the rapid stock removal that is required to meet such conditions. Wheels are made to fit all standard carbide tool grinders. Metal bonded diamond wheels are also made by the company, and they supplement the resinoid bonded wheels, particularly for off-hand grinding where the cutting surface sometimes is subject to extreme abrading action. Address J. K. SMIT & SONS, INC., Dept. TDJ, Murray Hill, N. J.
Circle Inform-A-Gram No. A6.



A THREE-FLUTE, CARBIDE-TIPPED END MILL, capable of plunging into solid metal, is announced by Nelco Tool Co., Inc. Designed to step up production and at the same time overcome many milling obstacles, the three-flute end mill provides more chip-room and thus obtains cooler and freer milling. This feature decreases the chance of work overheating and twisting. This new end mill is constructed to eliminate chatter, and it mills so smoothly that a finished cut is either not required at all or to a much lesser degree. Write for details to NELCO TOOL CO., INC., Dept. D, Manchester, Conn.
Circle Inform-A-Gram No. A7.



A BARTH CARBIDE DIE, pictured at the right with the razor blade strip it punches, has delivered over a million hits with no sign of increase in burr on the strip. This die is fed at the rate of 400 units per minute in a mechanical feeding device, which also recoils the strip stock after passing through the press. Special carbide dies of all types can be produced by the company. For complete information address BARTH STAMPING & MACHINE WORKS, INC., 3814 W. 34th St., Cleveland 9, Ohio.
Circle Inform-A-Gram No. A8.

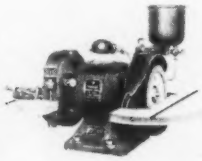


A NEW ADAPTER BASE, which converts almost any bench grinder into an accurate carbide grinding machine, has been developed by E. F. Hager and Son. The attachment makes available the same "reciprocating action" tool holder used in the large Hager Universal Carbide Grinder, and it permits accurate grinding of carbide tools with only a modest investment in new equipment. The reciprocating action produces a straight and smooth cutting edge and prolongs wheel life. The continuing motion prevents overheating of the carbide during grinding. E. F. HAGER & SON, Dept. TDJ, Queens Village 9, N. Y.
Circle Inform-A-Gram No. A9.

PROGRESS ON PARADE

TUNGSTEN CARBIDE DIES for many difficult jobs can be made by Cleveland Form Tool Company. Illustrated at the left is a tungsten carbide compound die for stator laminations. Dies such as this can be produced by the company with the help of the "Visual Grinder", an innovation in the grinding of tungsten carbide. CLEVELAND FORM TOOL CO., 6514 St. Clair Ave., Cleveland 3, Ohio.
Inform-A-Gram No. A10.

THE NEW PROSSER CARBIDE TOOL GRINDERS embody all the latest developments. Model AA (right) comes in both bench and floor types, takes 7" diameter silicon carbide wheels. Model EE is a floor model with ample power for grinding heavy tools and a provision for adequate wet grinding. For further details address THOMAS PROSSER & SON, Dept. TDJ, 120 Wall St., New York 5, N. Y.

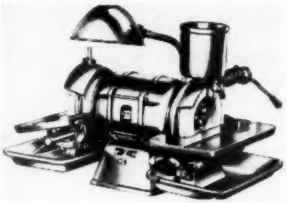


Circle Inform-A-Gram No. A11.

CARBIDE-TIPPED LATHE TURNING TOOLS, for free hand turning of soft metals, plastics and wood, are announced by Johns Manufacturing Co. Soft metals are extremely easy to turn. The razor-like edge that is ground on these tools is protected by a plastic top that can be removed by merely pulling it off. Write for complete information to JOHNS MFG. CO., Dept. R, Dunellen, N. J.

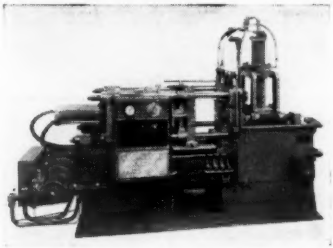
Circle Inform-A-Gram No. A12.

THE BALDOR CARBIDE TOOL GRINDER is designed to sharpen carbide tools quickly and accurately. Large enough in all respects to sharpen tools up to 1" wide, it can also be used for dressing down the steel shank in which the carbide tip is held. For details address BALDOR ELECTRIC CO., 4363 Duncan Ave., St. Louis, Mo.



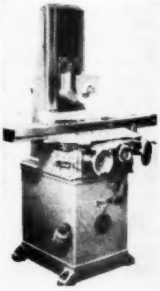
Circle Inform-A-Gram No. A13.

THE NEW MODEL 50 CLEVELAND DIE-CASTING MACHINE is a high pressure, hydraulic machine with a free cycle time of over 1000 shots per hour. This small size machine can be furnished either as a cold chamber unit for casting aluminum or as a gooseneck type for casting zinc, tin or lead. Either automatic or manual controls can be supplied. THE CLEVELAND AUTOMATIC MACHINE CO., 4931 Beech St., Cincinnati 12, Ohio.



Circle Inform-A-Gram No. A14.

GRINDING OF CARBIDE TOOLS can be handled to advantage on Reid Surface Grinders. Rough work can be done on the standard wheel; and finishing, on the diamond wheel. The new Power Feed Models have speeds varying from 12 to 35 feet per minute. REID BROS. CO., INC., 138 Elliott St., Beverly, Mass., will provide full details.

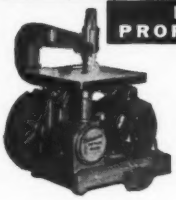


Inform-A-Gram No. A15.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

MILWAUKEE

DIE FILERS
PROFILE GRINDERS



DIE FILING

The MILWAUKEE does straight line, sharp corner filing, sawing and lapping. Labor savings up to 60%!

Profile Grinding

The MILWAUKEE Profile Grinder repairs dies, grinds cams, grinds and finish grinds steel parts.

Every Die Shop, Tool Room and Stamping Plant needs these latest model, low-cost machines for labor savings of Dies, Punches, Gauges, Templates, etc.

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Tap #0 to 3/4" with . . .

1 Commander TAPPER

- The Commander Tapper's exclusive torque control thinks for its operator —automatically stops when taps are dull, overloaded or strike bottom in blind hole tapping.
- You get maximum tap protection because the torque control can be set to protect all taps in the range from No. 0 to 3/4".
- Spring clutch drive eliminates slippage and wear—provides smooth, quiet, easy operation.
- Commander Tappers are furnished to fit any drill press.

Write for illustrated circular and name of nearest DISTRIBUTOR.

Any operator does precision tapping with a Commander TAPPER

Commander Mfg. Co., 4228½ W. Kinzie St., Chicago 24, Ill.

Product of Commander . . . Builder of the Multi-Drill

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PROGRESS ON PARADE

INVERTED CASING EXTRUSION DIE. A new extrusion die, made with extremely close tolerances by Willey's Carbide Tool Company, has a tungsten carbide insert. The inverted casing method, which insures permanent

mounting, rigidity and long life, was used in the making of this die. This type of die is ideal for cold heading operations. Complete information may be secured from WILLEY'S CARBIDE TOOL CO., 1346 W. Vernor Hwy., Detroit 1, Mich.

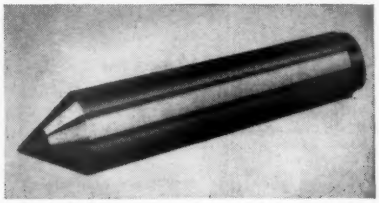
Circle Inform-A-Gram No. A16

THE TWIN-WHEEL CARBIDE TOOL GRINDER, for either wet or dry grinding, is announced by The Standard Electrical Tool Company. This grinder is convenient for one or two operators. Other features include stationary (tilting), degree-graduated tables; renew-

able steel wear plates on table tops; crank handle adjustment of splined spindle quill housing to compensate for wheel wear; copious coolant supply; and built-in exhaust outlets for dry grinding. Write THE STANDARD ELECTRICAL TOOL CO., Mt. Hope & Sixth Sts., Cincinnati 4, Ohio.

Circle Inform-A-Gram No. A17

CARBIDE-TIPPED LATHE CENTERS. Centers with 60-degree tungsten carbide tips are now being manufactured by South Bend Lathe Works. Because of their durability under



severe operating conditions, these centers are desirable for production jobs requiring high spindle speeds, long continuous cuts and heavy roughing operations. Write for additional data to SOUTH BEND LATHE WORKS, 391 E. Madison St., South Bend 22, Ind.

Circle Inform-A-Gram No. A18.

MECHANICALLY-HELD OFFSET TOOL. A new line of offset tools, having mechanically-held Kennametal tips, for machining operations such as facing with tool shank perpendicular to the work, or turning with the tool shank parallel to the work axis, is now being

produced by Kennametal Inc. The tip of these tools (Styles FRH and FLH) is held in position in a heat-treated steel shank by means of a spring steel clamp. When the tip becomes dull from use, it can be advanced and reground many times until a major part of the Kennametal is used. KENNAMETAL INC., 500 Lloyd Ave., Latrobe, Pa.

Circle Inform-A-Gram No. A19.

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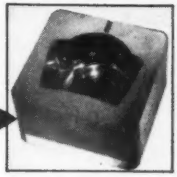
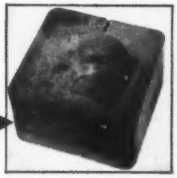


not this



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ARE YOUR RIVETING PROBLEMS "DIFFERENT"?

...THEN

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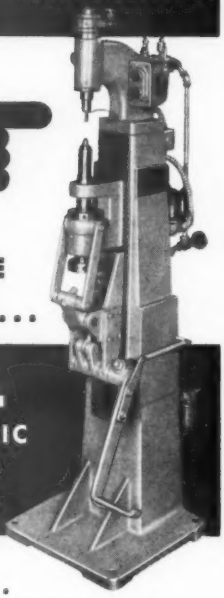
IS THE MACHINE FOR YOU...



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Have you a production situation where rivet-assembly is giving trouble? Are you getting bad heads, irregular results, too much scrap? Then it is time for you to investigate the HILL RIVETER — the modern, improved machine that is leading the way to lower costs. Write today for Bulletin HR — read all about it!

FREE DEMONSTRATION

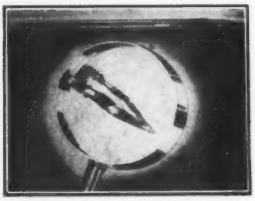
Send us *unriveted* samples of your problem pieces... let us show you what the HILL machine can do. No charge, no obligation of course.

HILL MACHINE COMPANY
1028 MULBERRY ST., ROCKFORD, ILL.

SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

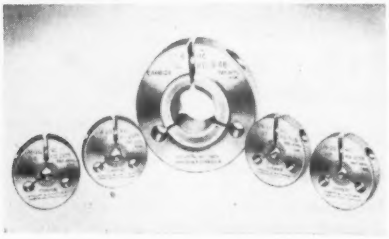
PROGRESS ON PARADE

THE NICO SCRIBER is made with tungsten carbide brazed into the core and extending from the tip of the steel handle. The carbide tip permits sharpening without burning or softening for many grindings, and it will efficiently scribe clean lines on tool bits, hardened steel, chromium or any other required surface. The scriber is equally useful on rusty



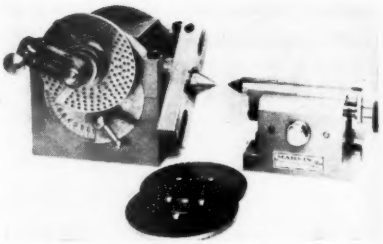
repair work. For further details on the NICO Scriber write NIAGARA INSTRUMENT CORP., Dept. TDJ, 58 Market St., Lockport, N. Y.
Circle Inform-A-Gram No. A20.

GO AND NOT GO CARBIDE DUALOCK ADJUSTABLE THREAD RING GAGES are made by Pratt & Whitney for long production runs where day-in and day-out accuracy must be maintained. They eliminate the hazard of gage



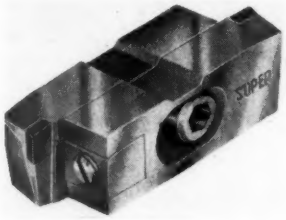
wear on close tolerance work and are excellent as master reference gages because of their long wearing qualities and stability. The AGD locking mechanism makes these gages adjustable. Full particulars may be had from PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Circle Inform-A-Gram No. A21.

A NEW DIVIDING HEAD that provides wide latitude in selecting various divisions to meet specific requirements is being marketed by Marvin Machine Products, Inc. It is designed for dividing operations required in gear cutting, layout, splines, fluting taps or reamers, cams, hex screws and squaring shafts. The unit comes complete with three index plates, each plate having six sets of holes. MARVIN



MACHINE PRODUCTS, INC., Dept. 100-TDJ, 414 Ford Bldg., Detroit 26, Mich.
Circle Inform-A-Gram No. A22.

A CARBIDE-TIPPED, EXPANSION TYPE ROUGHING BLADE for boring bars is announced by Super Tool Company. It has a range up to 4" and is ruggedly built for heavy cuts with extra support for the carbide tips.



The blade is expanded by loosening the set screws. A lock screw in the slide holds it in a fixed position. SUPER TOOL CO., 21654 Hoover Rd., Detroit 13, Mich.
Circle Inform-A-Gram No. A23.

NEW BALAS STOCK STOPS feature a Carboloy face that will not scuff or pick up material from the end of the bar, causing variations in length or damage to the finished end of the piece. Primarily intended for Brown & Sharpe machines, these stops are not limited

as to distance—they can be inserted into the turret—and the shanks are hardened to avoid nicking or scratching by the clamping mechanism. The diameters are 5/8", 3/4" and 1". Write BALAS COLLET MFG. CO., Dept. TD, 1557 E. 27th St., Cleveland 14, Ohio.
Circle Inform-A-Gram No. A24.

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This new method of checking tapers on dies does away with die squares and height gauges.

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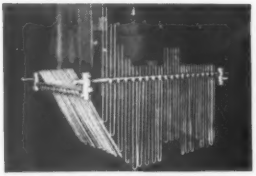

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"M" TEMPER ALLOY STEEL

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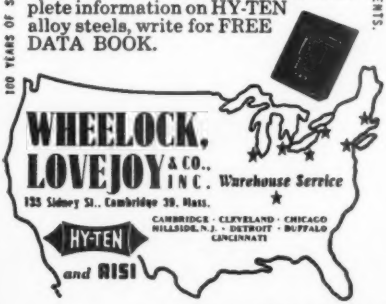


Peaslee

ENGRAVERS' CUTTERS

These are close tolerance cutters for use on high speed Milling Machines, Duplicators and Pantographs. Flats are ground from .0005 to .001 above center to cut your sharpening time and costs. Made from tough, wear-resistant steel; points and cutting edges stay sharp longer.

Our cutters are offered in two types of steel; "Red Label" for use on brass, bronze and non-ferrous materials; "Green Label" for roughing and heavy cuts on steel and ferrous materials.

Offered in taper shank single end, and straight shank single and double end; square, round and conical nose patterns. Write for Bulletin C-10.

Illustrated actual size; taper shank, single flute, conical nose cutter.

PEASLEE METAL PRODUCTS CO.

470 Tolland St., East Hartford 8, Conn.

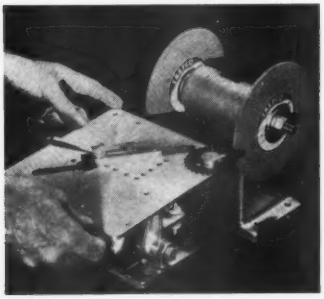
SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

PROGRESS ON PARADE

A NEW LINE OF CARBIDE LAMINATION DIES provides savings for manufacturers of electrical parts and precision stampings. The die shown, used for producing plunger laminations in .025" thick steel, can be resharpened up to 300 times and produces an aver-

age of one million hits per sharpening. Write for full particulars to CRESCENT TOOL & DIE CO., 1732 Southfield Blvd., Lincoln Park 25, Mich.
Circle Inform-A-Gram No. A25.

THE TREYCO MODEL 135 SHARPENING FIXTURE, for sharpening carbide-tipped tools, cutters and all types of circular saws from 1½" to 12" diameter, is announced. Also

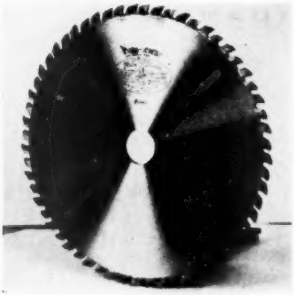


being introduced is the companion Model 300, dustproof, ball-bearing Grinding Wheel Stand. With the mounting of these two models on the same base, a permanent, self-contained sharpening device is ready for operation. Write TREYCO PRODUCTS, Dept. TDJ-1, 264 Hartford Ave., Kenmore 17, N. Y.
Circle Inform-A-Gram No. A26.

ALL TYPES OF CARBIDE GAGES, including the reversible carbide plug gage illustrated, are made by Size Control Co. The reversible style gages are furnished in both plain and

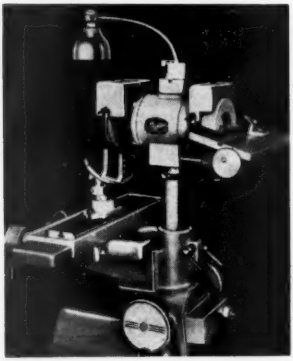
threaded members. Carbide gages will usually outwear steel gages by 30 to 50 times. SIZE CONTROL CO., 2500 W. Washington Blvd., Chicago 12, Ill.
Circle Inform-A-Gram No. A27.

MEYCO "VIBRA-FREE" CARBIDE-TIPPED SAWS. These circular saws feature a new construction that makes them practically vibrationless and, therefore, noiseless. Detailed in-



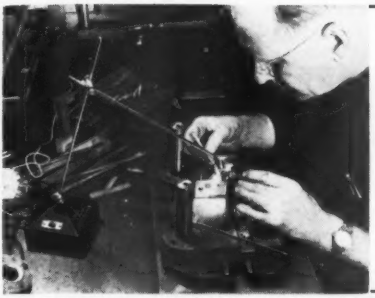
formation may be obtained from W. F. MEYERS CO., INC., Meyers Bldg., 1017 14th St., Bedford, Ind.
Circle Inform-A-Gram No. A28.

THE MODEL B804 UNIVERSAL CARBIDE TOOL GRINDER is built for fast and accurate grinding of single-point conventional tools. It



is precision made especially for this work by K. O. LEE CO., 1150 First Ave., S. E., Aberdeen, South Dakota.
Circle Inform-A-Gram No. A29.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION



UNEEDA LIGHT directs a beam of white light on your close precision work . . . .

Tool and Die Makers acclaim it for its utility, getting into nooks or crevices hard to get at with ordinary light—for lining up punches in dies, or working with the scriber in close places. Completely adjustable and portable. Light does not reflect back to your face. Ideal for Inspectors seeking burrs, flaws, etc. Price—complete with 2 size bulbs, $12.50.

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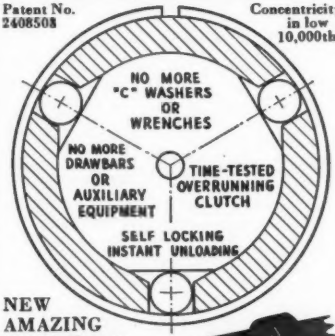
Concentricity in low 10,000ths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with the Patented RECIPROCATING ACTION

- Standard equipment includes Chip Breaker attachment and table for small radius hand grinding.
- Special attachments available for grinding of milling cutters, carbide reamers, boring tools, specially made cutting tools—and adaptable for general grinding of carbide.
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- Centrifugal pump supplies coolant under pressure to grinding surface.
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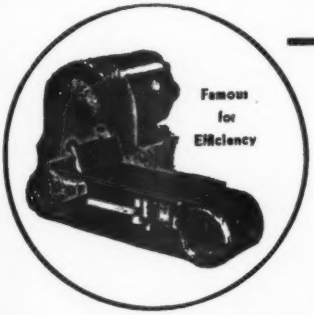

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This new, streamlined bench type grinder assures fast, quality finishing on metals, plastics, wood, fibre . . . at low cost. Built to machine tool specifications, Standard D-4 is equipped with improved band tension control and specially designed protective motor hood. 4x36¼" band. The ideal portable unit!

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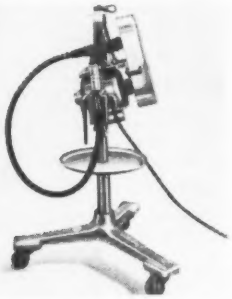
SEE ADVERTISERS INDEX, PAGE 135, FOR KEY NUMBERS

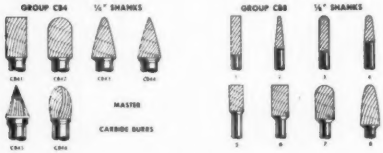
PROGRESS ON PARADE

ALL-PURPOSE FLEXIBLE SHAFT MACHINE. The Kellerflex "Series M" machine combines

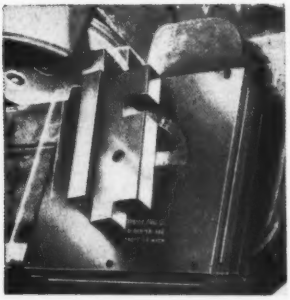


the best design features of older models with many refinements and modifications. This new model is made with 16 constant shaft speeds. PRATT & WHITNEY, Div. Niles-Bement-Pond Co., 15 Charter Oak Blvd., W. Hartford 1, Conn.
Circle Inform-A-Gram No. A30.

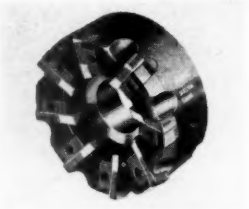
MASTER CARBIDE BURRS are ground 52 teeth per lineal inch with a radial rake and



a 30° spiral flute. They will cut any material up to 65 Rockwell C hardness and should be run at a minimum of 1500 sfm for best results. These burrs are available in eight shapes with 1/8" shank and six shapes with 1/4" shanks in a variety of sizes. Write METAL REMOVAL CO., 1016 N. Ashland Ave., Chicago 22, Ill.
Circle Inform-A-Gram No. A31.

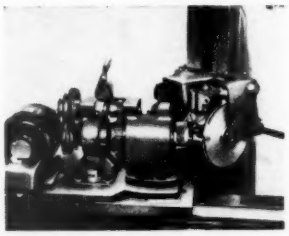


THE VIKING CARBIDE FACE MILLING CUTTER combines the stock removal qualities of brazed-on and serrated blade tipped cutters with the economical regrinding features of the all-carbide bladed face mills. The chief feature



of this face mill is a large carbide tip with just sufficient steel backing to effect the addition of serrations to the back of the blade. Address THE VIKING TOOL CO., Dept. T & D, P. O. Box 286, Shelton, Conn.
Circle Inform-A-Gram No. A32.

THE CIRCULARITY-GRINDING ATTACHMENT is a precision device for accurate and uniform production of radial relief, form relief and radial-and-form relief combined, on carbide cutting tools. For complete details write



DETROIT REAMER & TOOL CO., 2830 E. 7-Mile Rd., Detroit 12, Mich.
Circle Inform-A-Gram No. A33.

THE CARBIDE TOOL NO. 1 GRINDING FIXTURE accurately laps carbide-tipped tools and carbide inserts on a diamond lapping machine. The fixture wears wheels straight and even tends to straighten wheels worn otherwise, thus providing diamond wheel savings. The ball bearing ways at right angles to each other give action in any direction, retarded only by rolling balls. By the use of the No. 1 Fixture, a carbide tool is oscillated rapidly across the face of the diamond wheel. The fixture, when properly used, eliminates localized heat that builds up and causes thermal or grinding cracks if the tool moves too slowly. Any number of tools can be lapped on the same setup with angles within 10 minutes of each other. CARBIDE TOOL CO., 956 Harper Ave., Detroit 11, Mich.
Circle Inform-A-Gram No. A34.

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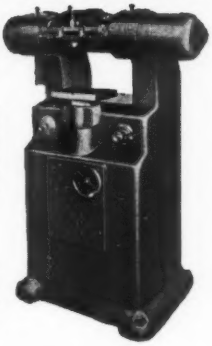

From a "kiss" impression to the crushing force of 12,000 pounds pressure, the No. 45 will deliver an unfaltering flow of power for every conceivable marking requirement.

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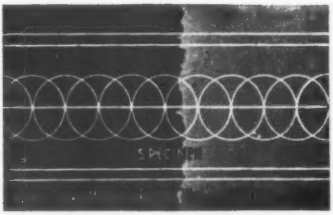

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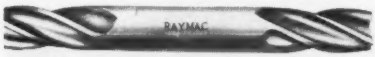
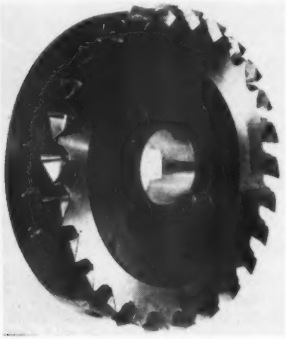
PROGRESS ON PARADE

SOLID CARBIDE END MILLS have been perfected by Raymac Mfg. Co., Inc., to increase production and lengthen tool life in the



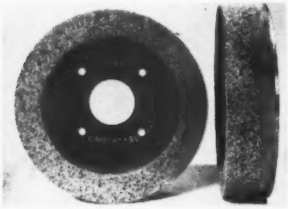
machining of tough alloys, plastics and soft metals. Double-end (pictured) and single-end solid carbide end mills are available in standard styles. RAYMAC MFG. CO., INC., Dept. TDJ, 3729 Cass Ave., Detroit 1, Mich.
Circle Inform-A-Gram No. A35

SUPER TRI-BIT FACE MILLS permit greater feed because of the closely spaced cutter blades. They are made for high production



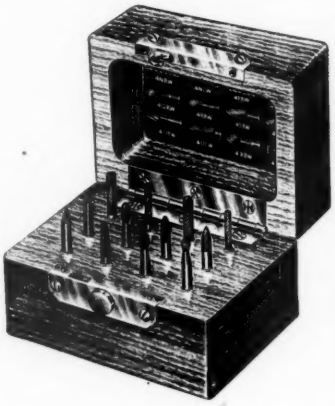
machining of frail malleable or alloyed castings. Carbide-tipped blades can be specified. Address WEDDELL TOOLS, INC., 31 Centennial St., Rochester, N. Y.
Circle Inform-A-Gram No. A36.

LOTENS GRINDING WHEELS have been developed expressly for the grinding of carbide tools. The silicon carbide wheels illustrated are made in a special "Cavity Clearance"



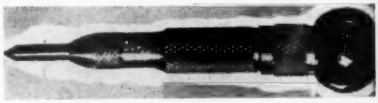
Structure No. 15, which has application to both the roughing and semi-finishing operations. Dry grinding has been substituted for wet grinding in some cases by use of these wheels. For complete data write to PRECISION GRINDING WHEEL CO., INC., Dept. T&D, 8301 Torresdale Ave., Philadelphia 36, Pa.
Circle Inform-A-Gram No. A37.

12 ASSORTED ⅛" SHANK NICHOLSON CARBIDE BURS are included in the new Carbiset No. 100. These tungsten carbide burs are excellent for cutting tough die steels, either in the unhardened or hardened stage.



The ⅛" shank burs will cut steel of a hardness up to C65 or C67, and are widely used by tool and die makers for fine and intricate work. Over-all length of each tool is ½". The mahogany box pictured comes with each set. For price and other particulars write NICHOLSON FILE CO., 95 Acorn St., Providence 1, R.I.
Circle Inform-A-Gram No. A38.

THE VINCO AUTOMATIC CENTER PUNCH is a mechanism that, when hand pressure is exerted, releases an internal spring-actuated hammer that strikes the point with sufficient



force to indent any unhardened metal. It increases the speed and the precision of marking, and produces punch marks of uniform, controlled depth. Tungsten carbide points for this punch can be supplied by the manufacturer for the marking of hard steel. VINCO PRODUCTS, Asbury Park 1, N. J.
Circle Inform-A-Gram No. A39.

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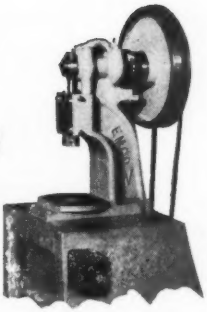
EMCO POWER PUNCH PRESS



Built and performs like a big press. Up to 18,000 operations per hour. Two sizes, "W" and "X"; 5 and 10 ton capacity, respectively. No repeating. Compact, powerful, long-lived, foolproof. Hundreds of pleased users.

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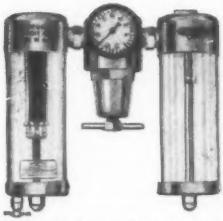

Filter removes water, dirt and sludge from line; REGULATOR gives any desired pressure. LUBRICATOR delivers automatically any desired amount of lubrication. These devices can be used as separate units or in any combination.

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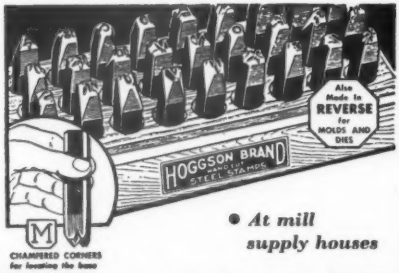
Deep, hand-cut letters in special-formula steel—result of 90 years of die making—assure clean impressions and long service. Face of stamp is angled for extra strength. Ideal for parts and tool marking and numbering. Also made in reverse for marking molds and dies.



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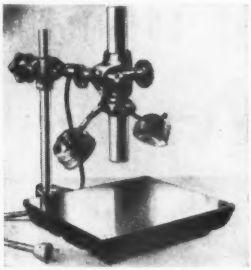


adjusted vertically and horizontally. Two lamps mounted on flexible tubing can be spotted on work being inspected. ALL AMERICAN TOOL & MFG. CO., 1014 W. Fullerton Ave., Chicago 14, Ill.

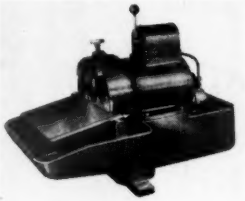
Circle Inform-A-Gram No. A40.

A CARBIDE GRINDING ATTACHMENT for the Cincinnati No. 2 Cutter and Tool Grinder offers the dual advantages of wet and dry grinding. This "Mist-Type Coolant System for Carbide Grinding" operates as follows: A thin stream of coolant is directed to the wheel and is transformed into a fine mist, which, instead

of being thrown off on the machine, operator and work, is immediately returned via a suction tube to the coolant tank. The unit can be readily set up or removed. THE CINCINNATI MILLING MACHINE CO., Dept. TDJ, Cincinnati 9, Ohio.

Circle Inform-A-Gram No. A41.

THE WICKMAN-NEVEN BENCH GRINDING AND LAPPING MACHINE is designed especially for sharpening carbide tools with a dia-



mond wheel. A coolant pump is furnished as standard equipment, with a reservoir cast in the machine base. The machine is powered by a 1 hp spindle motor designed to withstand frequent reversal and full use of steel-bonded wheels. WICKMAN MFG. CO., 15531 Woodrow Wilson, Detroit 3, Mich.

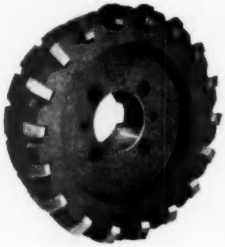
Circle Inform-A-Gram No. A-42.

SOLID CARBIDE MILLS have been added to the line of The Atrax Co. Suited to all kinds of milling operations, these mills eliminate loosening of brazed tips and provide greater

rigidity with a more even distribution of the load among the teeth. They are offered in sizes ½" and under. Write THE ATRAX CO., 240 Day St., Newington, Conn.

Circle Inform-A-Gram No. A43.

SERIES 3600 OK CARBIDE-TIPPED FACE MILLS feature dual adjustment. The blades are inclined at an angle to the face of the cutter. When these blades are moved out one serration, they are advanced radially and



axially at the same time, instead of only one way. OK TOOL CO., INC., Dept. TDJ, Shelton, Conn.

Circle Inform-A-Gram No. A44.

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HEAT TREATED
HIGH TENSILE STRENGTH

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⅝ x 2"	.....	.46 "
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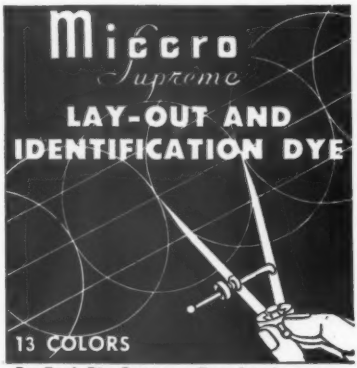

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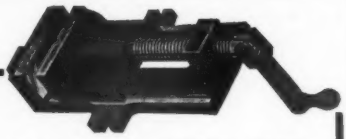

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Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
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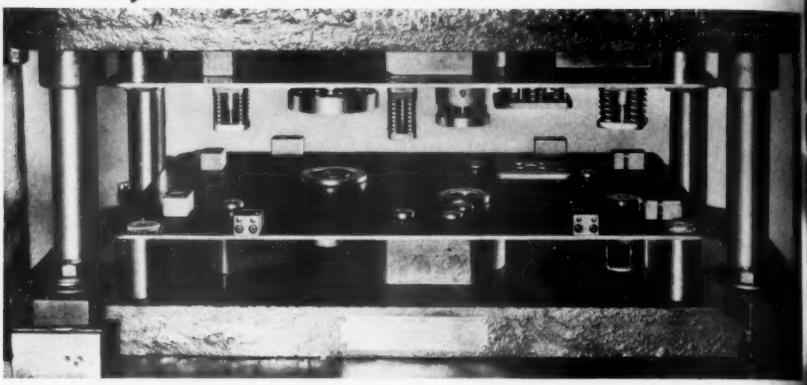

● Magnetic Perforating Die set-up in small inclinable punch press.

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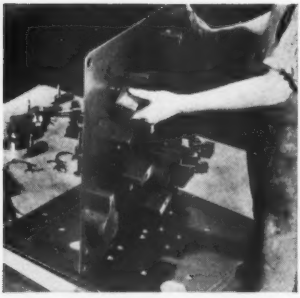

● Die retainers complete with bushings being inserted in die template.

SAVE PRESS DOWN TIME. Approximately 15 minutes required to change from punching one subject of say 20 holes to a different 20 hole arrangement. Whistler Magnetic Perforating Dies *increase* press production.

HOLD CLOSE TOLERANCES. Hole centers may be held to .0005″ accuracy or as close as can be jig bored.

GREATER PUNCH AND DIE LIFE. Concentricity of punch and die assured thus giving uniform clearance around punch, increasing punch and die life.

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REDUCE DIE COSTS. Whistler Magnetic Perforating Punch and Die units are used repeatedly for different hole arrangements. When completing one job, remove all units from templet and put them into service on the next different set-up. Combine any number of hole sizes and shapes. Punch and die costs are amortized over continued re-use in many jobs.

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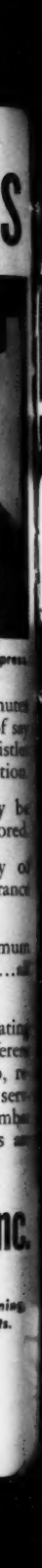
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